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FLIGHT

Aircraft, Spacecraft, Missiles

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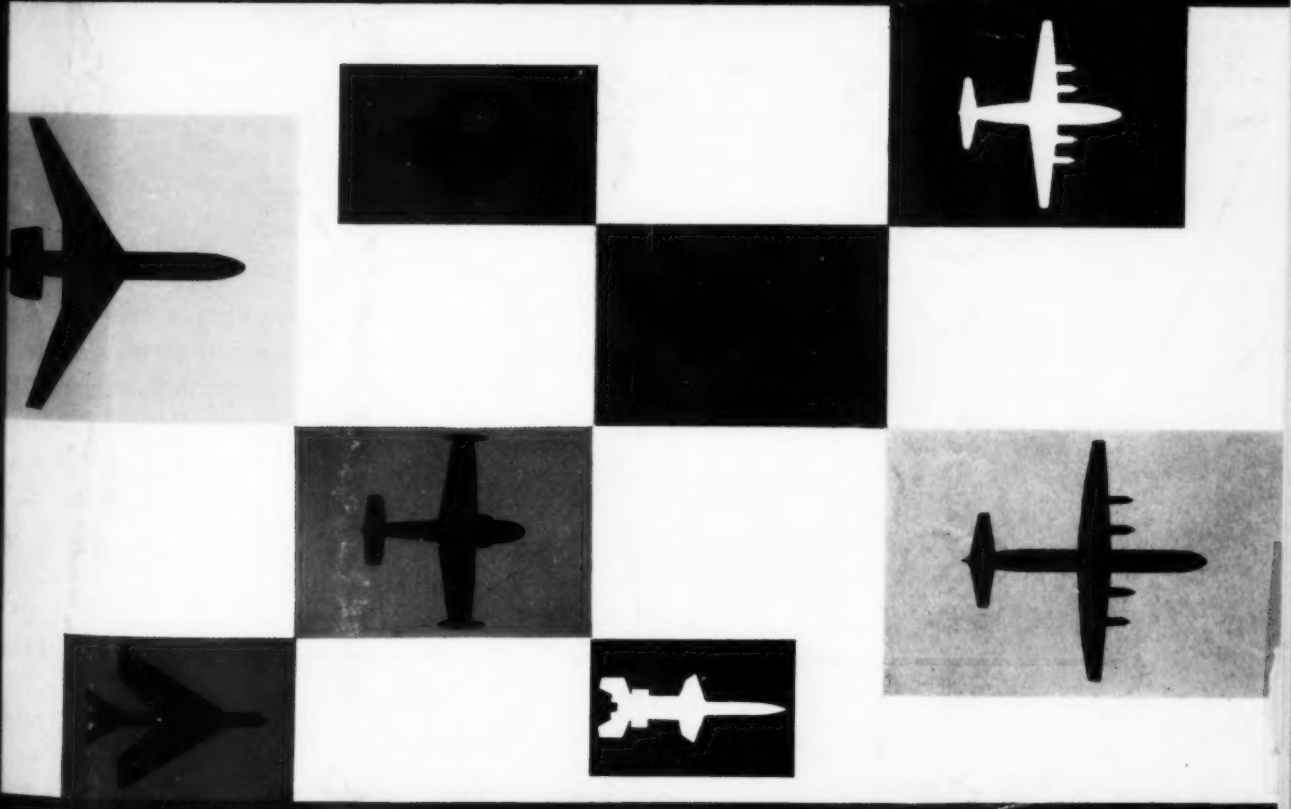

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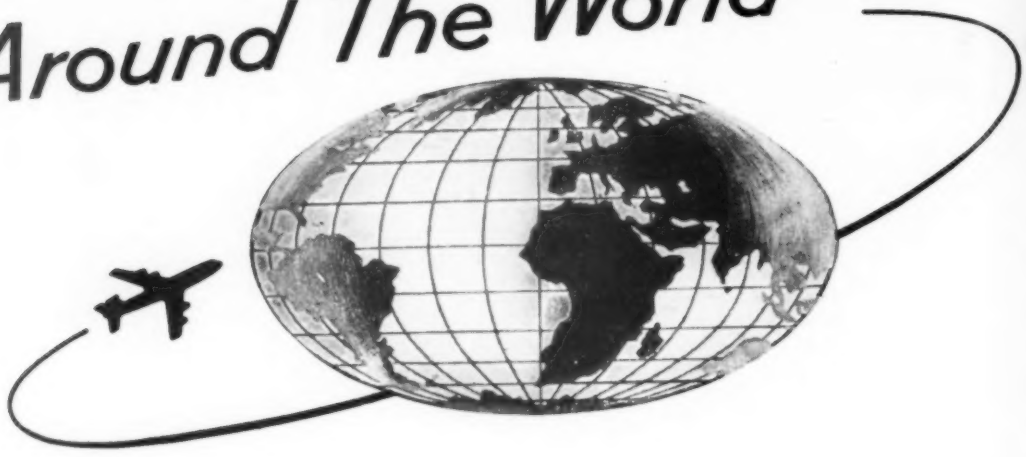

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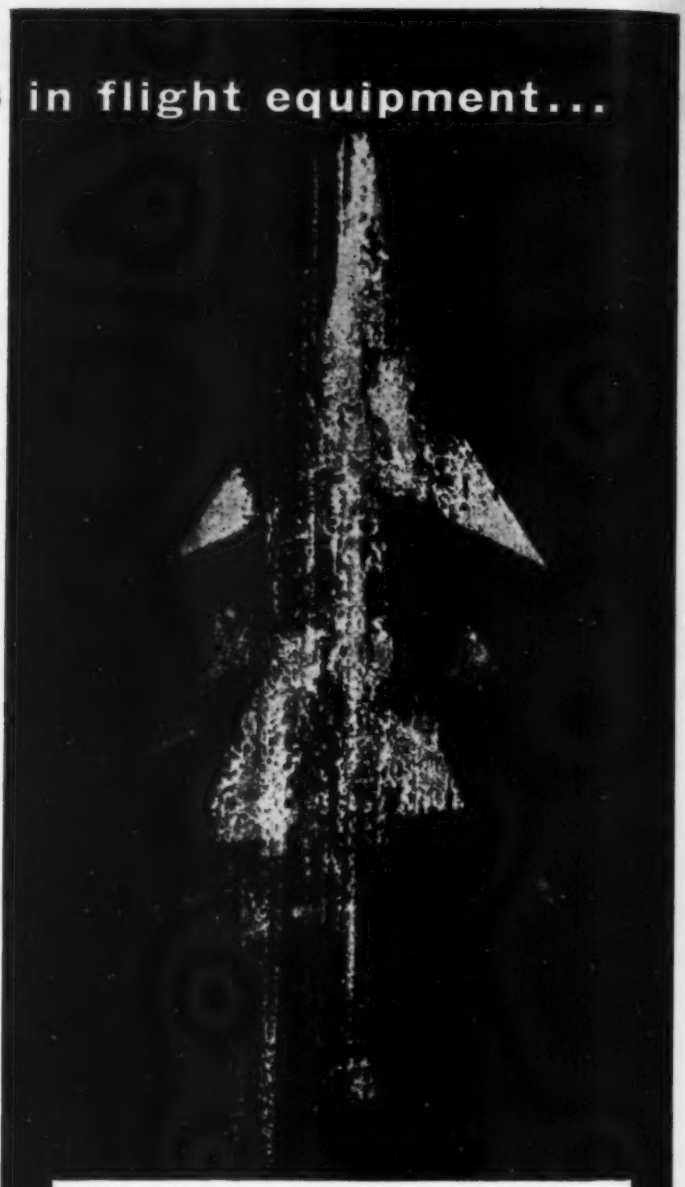

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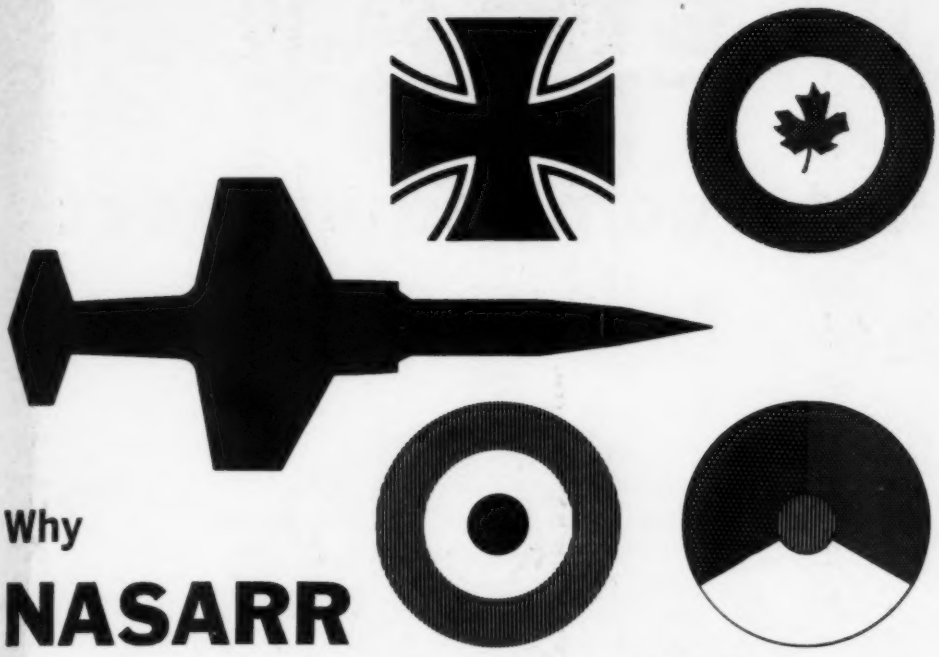

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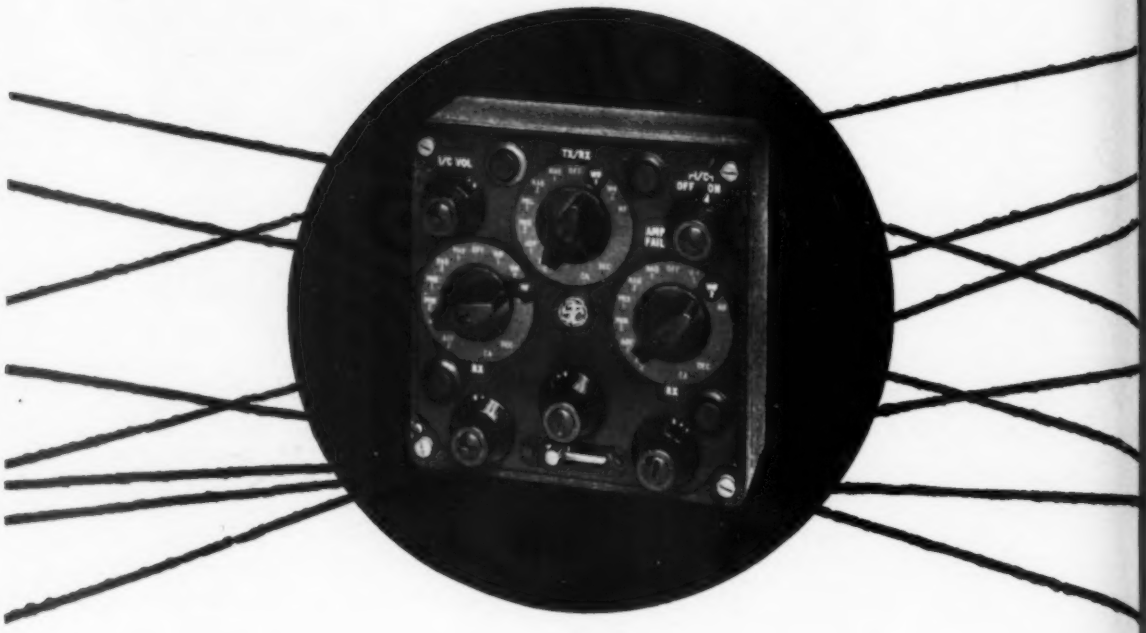

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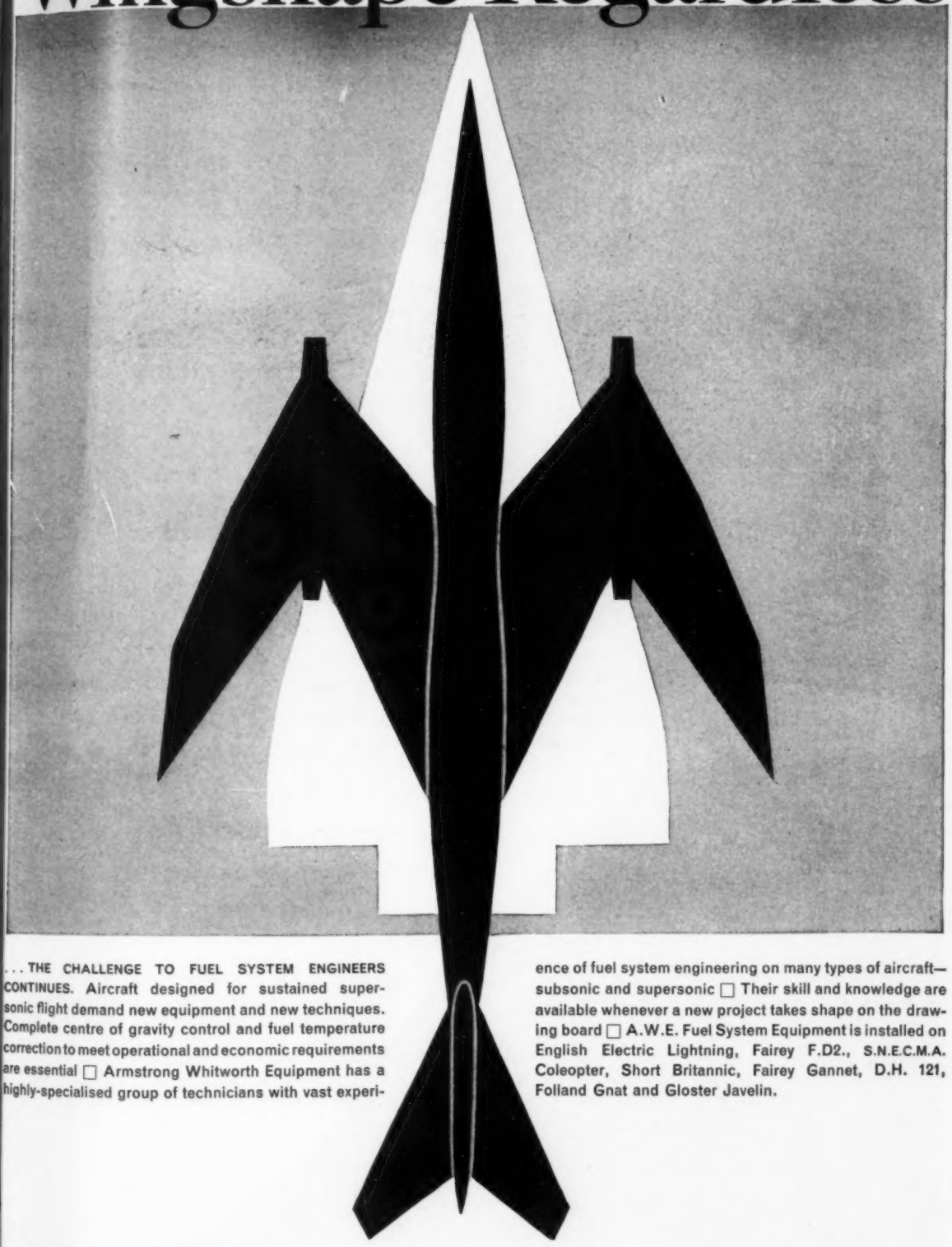

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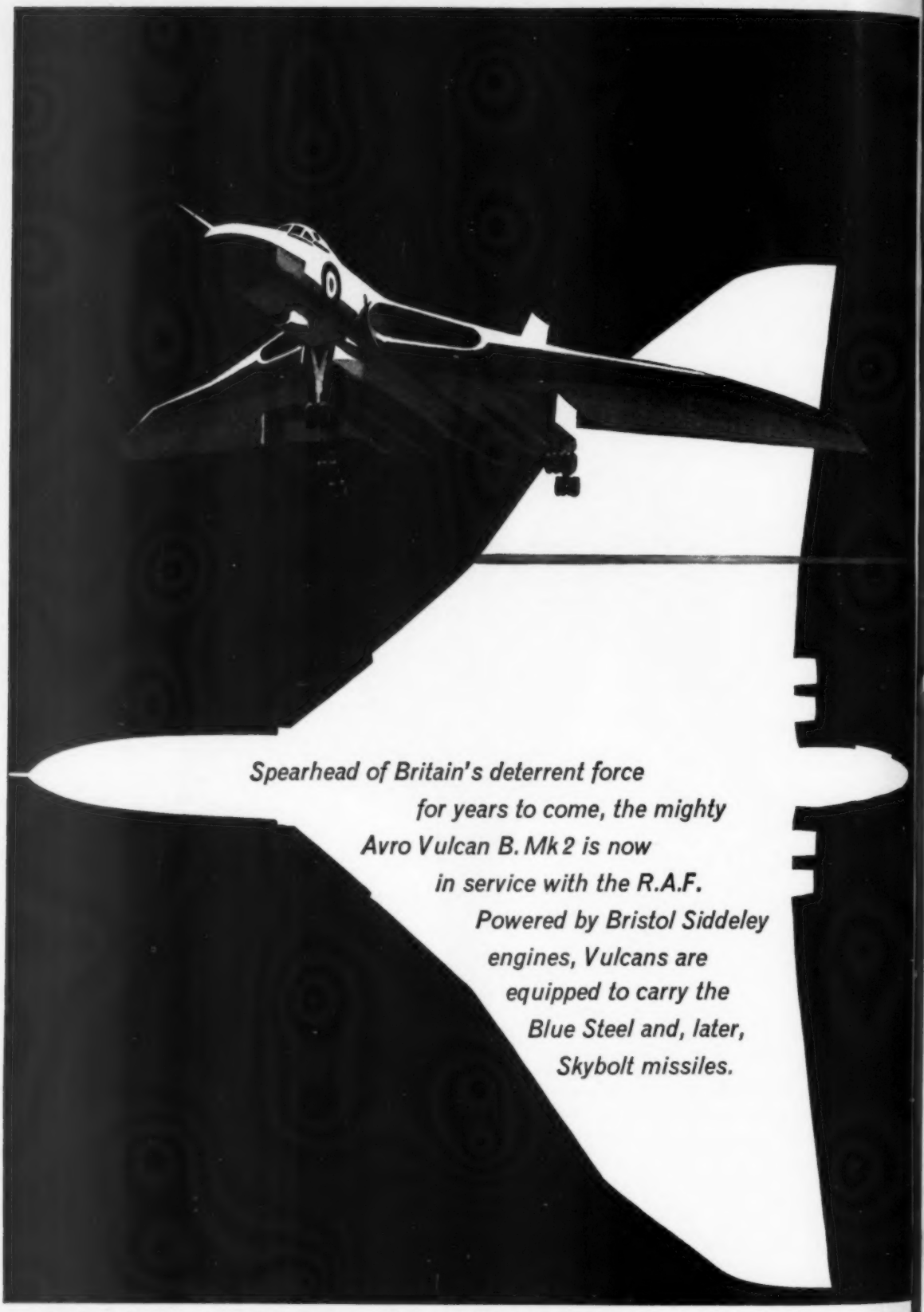
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No 2714 VOLUME 79 THURSDAY 16 MARCH 1961

FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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In the Cause of Safety

IT is with no morbid predilection that in recent months we have devoted an increasing amount of our editorial space to matters concerning air safety. In part the reason has been a series of major accidents, certain of which have emphasized that safety in air travel is not necessarily contingent on airframe, engine or system integrity; nor is it necessarily a matter of human fallibility. It may equally involve the environment in which today's commercial operations are conducted—as confirmed by recent collisions. Another reason for our preoccupation with safety has been the great professional and public interest in the jet fuel controversy, aroused first in this journal and latterly on television and in the national Press.

This week we print a paper by Mr Bo Lundberg, Director of the Aeronautical Research Institute of Sweden; his theme is that the development of the supersonic airliner should take second place to an intensive programme for enhancing the safety and efficiency of subsonic transport aircraft. As for supersonic flying itself, Mr Lundberg draws particular attention to the problem of cosmic radiation. It is well known, he remarks, that so-called total ionization is at a maximum around 70,000ft, which he believes will be the height at which supersonic airliners will fly. Some authorities, he says, seem to maintain that there is *probably* no danger at all; but others seem to be more dubious. These authorities are of the opinion that the risk of developing cancer might increase among passengers who flew frequently at such heights, and that the danger might be greater to future children of such passengers.

A Lesson from the Past

It is with no alarmist intent that we reflect on these matters. And in reflecting we cannot escape the recollection of past apathy. We need only instance the Guggenheim Safe Aircraft Competition of 1929. Its purpose was "to achieve a real advance in the safety of flying." The winner was the Curtiss Tanager, the runner-up the Handley Page Gugnunc—both fully slotted and flapped and both displaying remarkable low-speed handling qualities and speed range. Yet the subsequent application of high-lift devices was laggard and sporadic. The Gugnunc is now in the keeping of the Science Museum, where it is preserved not merely as a tribute to a brilliant piece of aircraft design but also as a monument to inertia and evasion. Handley Page themselves are content to remark "Had the aircraft's latent possibilities been appreciated more widely, far greater speed in flying and far greater safety in landing would have been achieved earlier than they were." It is not perhaps without significance that even in this context speed is given priority over safety.

This journal has never championed a cause or a policy lightly or expediently. Certainly the cause of air safety is not one for glib comment or hasty judgment. Indeed, our remarks on the subject may often appear equivocal and tentative. Yet this is unavoidable, especially when an accident is *sub judice*. Nevertheless, just as we have helped to bring into focus the jet fuel controversy, and that concerning rearward-facing seats, so we intend to continue to illuminate the subject of air safety from every aspect. Our faith in the future of the aeroplane as a vehicle of public transport is one which could hardly allow us to do otherwise. The Cairns report, reviewed in *Flight* last week, is a valuable contribution. Public accountability and honesty of purpose in all matters of air safety must be of increasing concern.

FROM ALL QUARTERS

Progress with the 1127

AS this issue closes for press the first flight of the Hawker P.1127 is imminent. It may be recalled that in *Flight* for December 2 we reported on the programme of free hovering completed—in only about a month—at the maker's airfield at Dunsfold, Surrey. The aircraft was then taken by road to RAE Bedford, where much additional equipment and instrumentation has since been added. The machine was ready at the end of the last week, and by the time this issue appears will probably have started flight trials as a conventional aeroplane from Bedford's runway. Later, the pilot—probably A. W. (Bill) Bedford—will accelerate the aircraft from the hover and reduce speed from forward flight until complete transitions have been accomplished.

Argosy and Belfast Loads

SPEAKING in the debate on the Army Estimates on March 7, the Under-Secretary of State for War, Mr James Ramsden, said that the Argosy or AW.660, which is coming into service this year as a tactical freighter, would carry a wide variety of equipment including the one-ton truck, 105mm pack-howitzer, Ferret scout car, and Wombat anti-tank gun. The Belfast strategic freighter has a payload of up to 35 tons and a range of up to 4,000 miles. It would carry the bigger pieces of equipment such as three-ton trucks, armoured cars, armoured personnel carriers, and guided weapons.

Sir Dermot Joins BAC

FORMERLY Chief of the Air Staff, from January 1956 until his retirement from the RAF at the end of 1959, Marshal of the Royal Air Force Sir Dermot Boyle, GCB, KCVO, KBE, AFC, has joined the board of British Aircraft Corporation. Another directorship announced by BAC is that of Mr A. D. Marris, CMG, a managing director of Lazard Brothers & Co Ltd (the merchant bankers) and a director of Barclays Bank, Peninsular and Oriental Steam Navigation Co and other companies.

RAF Manpower—and TSR.2

THE RAF's most serious manpower problem—the "one dark shadow on our manpower horizon"—was said last week by Mr Amery, the Air Minister, to be that of getting enough officers for the General Duties branch. It is only a question of a few hundred, he said, but unless we got them the sharp end of the Service would become blunted.

The Minister replied to an assertion that not a single piece of metal for the TSR.2 could be found if these islands were searched from Land's End to John o' Groats. He had made a few inquiries, he added, and had discovered that no further afield than his constituency of Preston he could find a "main tailplane spigot" under development. In Accrington, "wing plans" were being made.

US Firm to Make Ekco Radar

A LONG-TERM contract has been signed between Ekco Electronics Ltd and Wilcox Electric Co, of Kansas City, under which the American company will manufacture and distribute Ekco weather radar in the United States. Production will begin in a few months in a new factory, and sales should reach at least $1m annually.

Such equipment is now mandatory in most US airliners. The latest Ekco weather radar, largely transistorized, weighs only 57lb. The electronic units can be duplicated to provide full stand-by, and all controls are grouped round the indicator, so that no separate control panel is required.

Negotiations between the two companies began in January and the contract was signed by Mr A. J. Brunker, director and general manager of Ekco Electronics, and Mr Jay V. Wilcox, president of Wilcox Electric. The two companies will be able to work together as a team on new developments in the radar field and widespread interchangeability of products for domestic and foreign airlines should result.

CYRANO DE MERIGNAC: This long-nosed conversion from SFERMA's factory at Mérignac is the Nord 1110 with Turboméca Astazou (see news item above). Note the slender engine, Ratier-Figeac propeller in zero pitch and extended (black) intake trunk

ONE AVON 67 makes the Mirage IIIO probably the fastest aeroplane flying in Europe. Dassault and Rolls-Royce have effected an excellent conversion, which is now being evaluated for the RAAF

Beverley Quinquennium

ON Sunday last the Blackburn Beverley completed five years in operational service, for it was on March 12, 1956, that the first of these aircraft was delivered to RAF Transport Command. Since that date Beverley squadrons operating from bases in the United Kingdom, the Far East, Aden Peninsula and Kenya have between them amassed some 75,000 hours' flying and carried 150,000 tons of freight in addition to many thousands of passengers. The aircraft have taken emergency supplies into Mauritius, Agadir and the Congo, have participated in airborne exercises to Norway and North Africa, have flown into Jordan, Austria and New Zealand and are used regularly for the continuation training of parachute troops. Beverleys were initially described, on entering RAF service, as having "given an entirely new significance to the term 'air portability'"; it was stated that the aircraft's huge freight compartment (40ft × 10ft × 10ft) "literally opens the doors to a vast new range of Service equipment and stores which hitherto could not have been carried by air."

Turboméca Astazou in Britain

LAST week Blackburn Engines, who are licencees and distributors for Turboméca, combined with the French company to demonstrate at Gatwick the 560 h.p. Astazou turboprop installed in the Nord 1110 test-bed. Representatives from BEAGLE, Shorts, Hunting, Scottish Aviation, Westland, Handley Page and the Air Ministry attended and were given demonstration flights; Mr Peter Masefield, BEAGLE managing director, was aboard for the 500th flight of the aircraft; it had flown 52hr in the previous 20 days. The remarkable constant-speed control system of the Astazou was described in *Flight* for May 6, 1960.

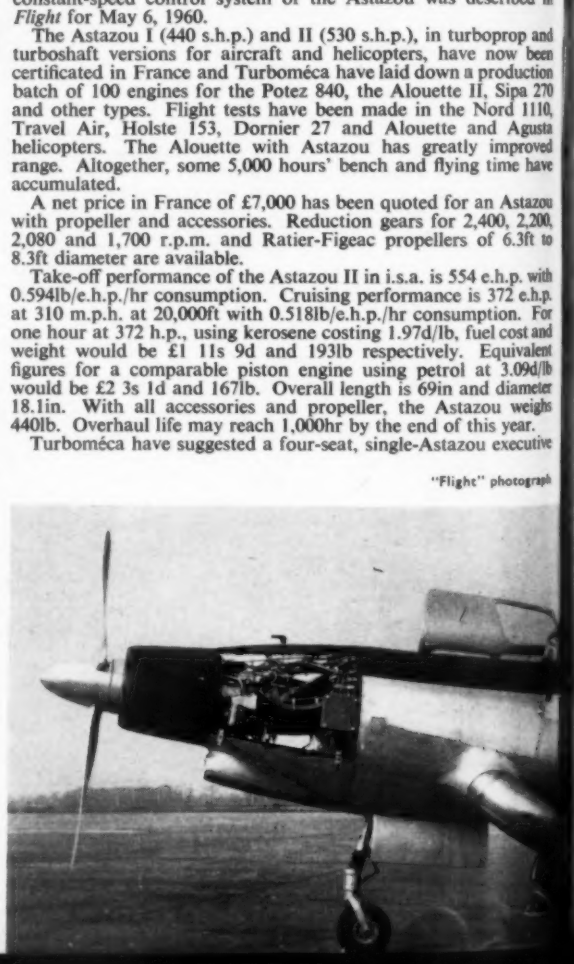
The Astazou I (440 s.h.p.) and II (530 s.h.p.), in turboprop and turboshaft versions for aircraft and helicopters, have now been certificated in France and Turboméca have laid down a production batch of 100 engines for the Potez 840, the Alouette II, Sipa 270 and other types. Flight tests have been made in the Nord 1110, Travel Air, Holste 153, Dornier 27 and Alouette and Agusta helicopters. The Alouette with Astazou has greatly improved range. Altogether, some 5,000 hours' bench and flying time have accumulated.

A net price in France of £7,000 has been quoted for an Astazou with propeller and accessories. Reduction gears for 2,400, 2,200, 2,080 and 1,700 r.p.m. and Ratier-Figeac propellers of 6.3ft to 8.3ft diameter are available.

Take-off performance of the Astazou II in i.s.a. is 554 e.h.p. with 0.594lb/e.h.p./hr consumption. Cruising performance is 372 e.h.p. at 310 m.p.h. at 20,000ft with 0.518lb/e.h.p./hr consumption. For one hour at 372 h.p., using kerosene costing 1.97d/lb, fuel cost and weight would be £1 11s 9d and 193lb respectively. Equivalent figures for a comparable piston engine using petrol at 3.09d/lb would be £2 3s 1d and 167lb. Overall length is 69in and diameter 18.1in. With all accessories and propeller, the Astazou weighs 440lb. Overhaul life may reach 1,000hr by the end of this year.

Turboméca have suggested a four-seat, single-Astazou executive

"Flight" photograph



YAK-23 is the designation of this Russian jet trainer, which, flown by Valentin Mukhin, recently attained a height of 14,283m (46,860ft). The achievement has been submitted to the FAI as a class record

FOUR BAGS FULL: This buoyant Wessex HAS.1 has been modified by Westland Aircraft under MoA contract to incorporate large flotation bags. It will be seen to have a new twin-wheel main leg

type which could cruise at 300 m.p.h. but still have the normal CAR.3 field-lengths of about 300yd without special high-lift devices. It would cost about £15,000, as compared with £10,000 for an aircraft like the Bonanza.

New Conrad Record

EIGHT days, 18hr and 49min after taking off from Miami Airport on February 27, Max Conrad and Dick Jennings arrived back in Conrad's Piper Aztec on March 8 after a record-breaking 25,460-mile flight around the world. The previous light-aircraft record was of 29 days, set up by the late Peter Gluckman in August and September 1959 in a Meyers 200.

Conrad was hoping to gain records in three categories: world records for piston-powered aircraft and for Class C-1d aircraft (1,750-3,000kg); and the US national record in the C-1d category. His route (stage distances in parentheses) was: Miami - Long Beach, California (2,326 miles) - Honolulu (2,568) - Wake (2,300) - Manila (3,029) - Singapore (1,480) - Bombay (2,433) - Nairobi (2,821) - Lagos (2,382) - Dakar (1,523) - Trinidad (2,969) - Miami (1,625).

Illuminated Corkscrew

ONE of the lesser known activities of Armstrong Whitworth Aircraft is the construction of scale models. Now being built are three seventh-scale replicas of the Hunter Two-Seater, to be used in spinning tests. They are made of Fibreglass, weigh 120lb each, and will provide an "illuminated corkscrew" as distinct from Bill Bedford's now familiar smoke-trail. The makers say that the aim is to simulate a spin from 30,000ft, for which purpose the models will be released and allowed to fall freely from a helicopter at about 3,000ft. As they spin, a light in the nose will flash every time the controls go over. A time switch will release a recovery parachute at a predetermined height. Fluorescent paint bands, spanwise on the starboard wing and chordwise on the port wing, will identify the attitude of the model on film.

M Max Hymans

IT is with regret that we record the death, in Paris on March 7, of M Max Hymans, honorary president of Air France. He became president of the airline in 1948 and retired only last January to become honorary president. Born in 1900, M. Hymans served during the war with the Free French Forces in England, taking part in the organization of Allied secret service in France.

Getting the Record Straight

IN a recent statement the chairman of English Electric and D. Napier & Son Ltd, Lord Nelson of Stafford, said that certain press comments on his annual report to shareholders had implied that Napier were going out of the aero-engine business. These, said Lord Nelson, were without foundation; work was continuing on present and future projects. [No such comments appeared in *Flight's* note on the report.]

IN BRIEF

Kawasaki Aircraft Co have placed an order with the Vertol division of Boeing Airplane Co for ten Boeing-Vertol 107 helicopters. This follows the announcement of a US Army contract valued at $25m (£8.9m) for 18 additional HC-1B Chinook medium transport helicopters, largest member of the 107 family.

Short Bros & Harland are to receive substantial financial assistance from the Northern Ireland Government to enable them to carry out the contract for ten Belfasts ordered for RAF Transport Command. A resolution permitting loans of between £4m and £6m on favourable terms was to be introduced into the Northern Ireland House of Commons. The first of the aircraft is due to be flown from Sydenham early next year.

It has been pointed out that the remarkable mosaic reproduced in *Flight* last week was exhibited at the ninth International Congress of Photogrammetry held last September and not to take place "this year." The camera was a Williamson F49 Mk 2 with Ross wide-angle lens.

The aerobatic competition for Elwyn McAully Trophy, to be held at Little Snoring Aerodrome during the weekend of March 25-26, will be open to Tiger Club members who have not more than 250 hours' total flying time and have not taken part in any open aerobatic contest; members of other clubs, in certain circumstances, may also compete. Information from Mr Denis Kirkham, 183 Drayton High Road, Drayton, Norwich.

Air Chief Marshal Sir Harry Broadhurst (portrait, page 349) took up his new post as Avro managing director on March 6. He succeeds Mr J. A. R. Kay, who has moved to St James' Square as Hawker Siddeley Aviation sales director. Armstrong Whitworth Aircraft announce that Mr Eric S. Greenwood, whose appointment to their staff was reported last week, is now to be known as technical sales manager. Yet another Group appointment is that of Mr R. M. M. Biden as area manager, West Africa, for all HSA companies.

Subject to confirmation, a world gliding record for absolute altitude of 46,267ft has been set up by Paul F. Bikle, flying a Schweizer 1-23E in a stationary wave in the region of the Sierra Nevada mountains. The gain of height which Mr Bikle claims for this flight—42,300ft—should also be a new world record.

The 21st anniversary of the formation of the Rhodesian Air Training Group, and the 20th anniversary of the beginning of flying at the Mount Hampden station of the group, will be celebrated at a reunion of the Mount Hampden Reunion Club at the Punch Tavern, Fleet Street, London, at 7 p.m. on April 1. Details from Mr C. A. Nepean Bishop, 49 Zermatt Road, Thornton Heath, Surrey.

A remarkable new British fast car is described in tomorrow's (March 17) Spring Number of *The Autocar*.

ON THE DOTTED LINE: Signing the contract for weather radar production between Wilcox and Ekco are Mr Jay V. Wilcox (left), president of Wilcox Electric, and Mr A. J. Brunker, director of Ekco Electronics. Looking on are (left) James E. Gardner, executive vice-president of Wilcox, and (right) P. L. Stride, manager of the aviation division of Ekco. *(See news item on the opposite page)*

Maj Robert White, fastest man in the world, stands at the nose of the X-15 research aircraft in which he achieved 2,905 m.p.h. on March 7. Stripes on the nose record temperature levels indicated by heat-sensitive paint (see "X-15 Reaches 2,905 m.p.h.")

Missiles and Spaceflight

X-15 REACHES 2,905 M.P.H.

Now that the LR99 rocket engine (described in *Flight* for November 25) has settled down in flight as the powerplant of the North American X-15 research aircraft, the way is clear for the NASA test pilots concerned to explore the flight envelope of the aircraft to its limits. On March 7 the single X-15 so far to have flown with the engine reached a speed of 2,905 m.p.h., in the hands of Maj Bob White. This speed, which exceeds by 630 m.p.h. the highest reached with the interim LR11 engine, was achieved at roughly half-power at 75,000ft. The temperature-sensitive paint on the X-15's nose turned "from green to blue, yellow, black and finally brown," indicating approximately 680°F.

SPACE DOG MAKES GOOD

The second successful launch, orbit and recovery of a 10,360lb dog-carrying satellite was achieved by the Soviet Union on March 9. This brought Russia's score in her programme aimed at manned orbital flight to two successes out of four announced attempts. The basic aim of the March 9 launch was stated to be "The further testing of the design of the space-ship and the systems installed in it which ensure the necessary conditions for manned flight. . ."

Prof Dobronravov commented that the experiment had confirmed the launching system's increased accuracy and also the reliability of the guidance system "which was, in fact, what the experiment was meant to prove." It was stated officially that the satellite had been in an orbit with an apogee of 155 miles and perigee of 114 miles, and that, following a radio command from the ground, it re-entered and came to Earth in the prescribed area in the Soviet Union.

The dog, named Chernushka (Blackie), was reported to be in good health after the flight, and was accompanied in the satellite by "other living objects." On March 11, some of the animals which accompanied Chernushka were identified by Tass as guinea pigs, black mice and insects. Initial examination had shown that all were in excellent condition.

Equipment in the satellite included telemetry and television systems, radio communication units and a radio system for trajectory measurements. The official announcement said that all worked normally and that valuable data were obtained.

Commenting in Washington on the Soviet achievement, Mr George M. Low, chief of the manned spaceflight programme of the National Aeronautics and Space Administration, said that it suggested that the Russians were "about ready to put a man up there."

Previous firings of 10,000lb Earth satellites by the Soviet Union have comprised:

Sputnik 4. May 14, 1960. Orbit achieved 189-229 miles. Carried "dummy man" in pressure cabin which separated but, instead of re-entering atmosphere as planned, went into orbit of 191-429 miles.

Sputnik 5. August 19, 1960. Orbit achieved 190-211 miles. Carried two dogs and other animals. Successfully recovered on 18th orbit on August 20, 1960.

Sputnik 6. December 1, 1960. Orbit achieved 112-155 miles. Carried two dogs and other animals. Attempt to re-enter and recover failed; satellite burned up on re-entry.

Between the December 1 launch and that of March 9, there was the launch of Sputnik 7 weighing 14,293lb into an orbit of 139-204 miles on February 4; and that of Sputnik 8, conceivably of a similar weight, on February 12. It was from this satellite that the Soviet Venus probe was launched into its interplanetary trajectory. Sputniks 7 and 8 were reported to have re-entered the Earth's atmosphere and burned out on February 26 and February 25 respectively.

BLUE STREAK COSTS AND PROSPECTS

In the Commons on March 6 the Minister of Aviation said that the total cost of the Blue Streak military project up to the date of cancellation, including an allowance for charges not yet negotiated with contractors, amounted to "some £84m." The cost of work to keep a peaceful launcher project open as a possibility had been £2.5m up to the end of February. If the project were completely cancelled there would be in addition terminal costs to be negotiated.

Current monthly maintenance costs, previously quoted by Mr Thorneycroft as "about £300,000," were re-quoted by him as "between £300,000 and £350,000" in reply to a further question. This figure, he said, included Spadeadam but not Woomera: "The figure obviously does not include the whole cost of Woomera, because Woomera is going on perfectly well without Blue Streak. Woomera is a very much bigger undertaking. All our main rockets and guided missiles are tested there."

Mr George Chetwynd asked whether it was worthwhile going ahead with Blue Streak as a space launch vehicle in view of an article which had appeared in that day's *Guardian*. Mr Thorneycroft replied that there was a real possibility of something which could be of immense value to Europe, and "It would be foolish to cast that opportunity aside without exploring every possibility of going forward with it."

The *Guardian* article referred to by Mr Chetwynd was written by the paper's defence correspondent, Leonard Beaton, under the title *Is Britain Blundering into Space?* In it, Mr Beaton wrote: "The Government's plans for a European space programme are an intelligent and well-meaning mistake. In the hope of making the most of the £100 millions investment in Blue Streak, they are heading directly for the waste of another £100 millions; in playing what they see as a card of re-entry into Europe, they are storing up future trouble with our European friends; in laying the foundation for a British satellite communication system, they are condemning it to launchers which will certainly be late and expensive and may be less accurate than their rivals; and in getting into the space business, because you never know where it will lead, they are putting off by five years or more the development of economical rocketry in this country. . ."

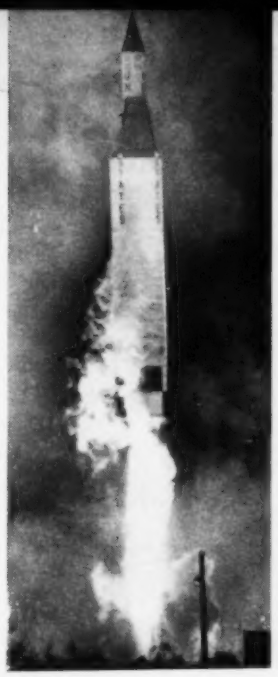
PATRICK HENRY ARRIVES

After a record submerged voyage of 11,000 miles in 66 days 22hr, USS *Patrick Henry* sailed up Holy Loch, Dunbartonshire, on March 8 and anchored along the starboard side of her depot ship *Proteus*. The submarine, the second FBM ship to commission in the 14th Submarine Squadron, submerged off New London, Conn, on December 30; and on her way to Holy Loch fired eight Polaris A-1 missiles, presumably down the Atlantic Missile Range. Under Capt Harold E. Shear was the ship's Blue Crew of 13 officers and 122 enlisted men (and five civilian technicians); when the ship leaves she will be manned by her Gold Crew.

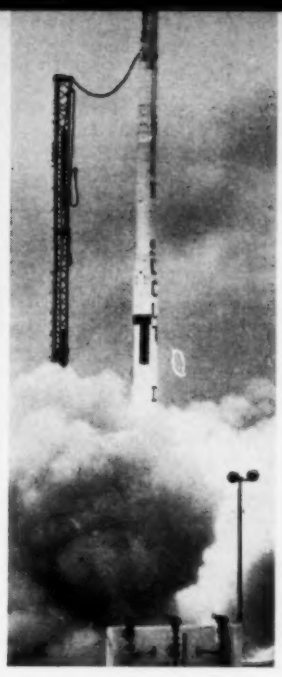
ION ROCKET DEVELOPMENT

A twelve-month study of ion rockets, using realistic thrust, power supply and weight data to determine payloads, trajectories and engine operating times for specific deep space missions, is to be carried out by the Research Laboratories of United Aircraft Corporation, East Hartford, Connecticut, under NASA contract. The study will include the optimum calendar times for particular launches and a dual thrust propulsion system (combination of ion and chemical power).

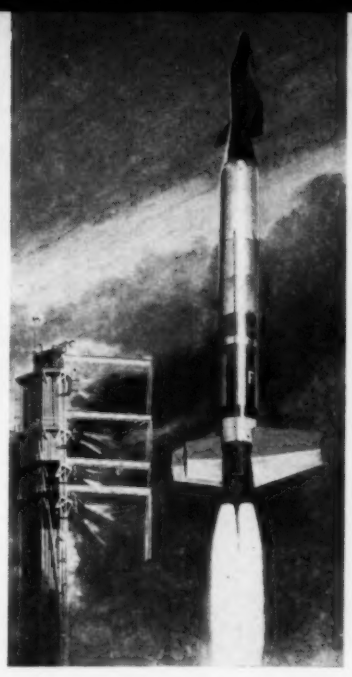
The earliest ion rockets to be considered for spaceflight will have a thrust of one-tenth of a pound and will be powered by 30kW SNAP-8 nuclear reactors after first-stage launch by Atlas-Centaur or Saturn C-1 boosters. Higher-powered ion engines (up to one megawatt) will also be considered.



Left, Juno 2 launch from Cape Canaveral on February 24 in unsuccessful attempt to orbit ionospheric beacon satellite



Centre, Blue Scout 2 launch from Cape Canaveral on March 3 in successful test of the four-stage rocket. A 172lb radiation payload was carried to 1,580 miles



Right, artist's impression of the launch of a Dyna-Soar boost-glide vehicle by means of Titan 2 (see news item "Dyna-Soar Third Stage")

SATURN TANK CONTRACT

The US National Aeronautics and Space Administration has negotiated with four companies on a contract to provide 70in-diameter first-stage tanks for five Saturn launch vehicles. The firms are Boeing, Chance Vought, Martin and Chrysler, and the contract is worth some $2.25m.

The complete 22ft-diameter Saturn S-1 stage will be assembled at the George C. Marshall Space Flight Center at Huntsville. Each stage contains nine tanks—a central 105in-diameter liquid oxygen tank and a cluster of eight of the 70in tanks for RP-1 and additional liquid oxygen.

Earlier this month NASA announced that Chance Vought had been awarded the contract, with delivery scheduled to begin in April 1962. The company will provide 40 tanks for the five Saturn vehicles, and two spare tanks.

DYNA-SOAR THIRD STAGE

Our American contemporary *Missiles & Rockets* has reported that the Dyna-Soar hypersonic glider will have a third stage of propulsion. The main booster will be the two-stage Titan 2, as portrayed in the artist's impression (above right). Previously, Titan 1 had been chosen, but this system confers inadequate burnout velocity. The third stage is the tapering section added between the fuel tank of the Titan second stage and the base of the hypersonic vehicle itself. A solid charge is used, based on the second stage of the Minuteman ICBM, with a glass-wrapped casing. Not only does this provide a valuable increment in velocity but it also serves as the escape rocket for use in the event of major trouble on the pad or immediately after take-off. Dyna-Soar itself has no propulsion, although a system of small rockets is provided for correcting attitude.

12,000,000lb STUDIES

Convair, Lockheed and North American Aviation were on March 10 awarded study contracts by NASA for rocket systems with first-stage thrusts of 6,000,000 to 12,000,000lb. Lockheed, at least, may be expected to investigate solid propellant.

On March 9 a successful flight from Cape Canaveral was achieved by a Redstone carrying devices for the automatic arming and fuzing of a nuclear warhead during flight.

A Skylark sounding rocket was fired from Woomera on March 6 carrying experiments designed to study (according to Mr A. S. Hulme, Australian Minister of Supply) winds and temperatures in the upper atmosphere. At a height between 100 and 120 miles a cloud of sodium was emitted from the rocket.

Today, March 16, HRH Princess Margaret is due to launch the Royal Navy's second guided-missile destroyer, HMS *Hampshire*. Like her predecessor, HMS *Devonshire* (*Flight*, June 24, 1960, page 859) she is armed with a twin Seaslug launcher and two quadruple Seacat installations.

It is announced by Goodyear that special disc brakes will be used to clamp the elevating launch platform used in the Atlas hard silo (*Flight*, November 4, 1960, page 707). The brake will provide fail-safe platform locking in the event of hydraulic or electrical failure, but its primary purpose is to withstand the dynamic loads imparted during a missile firing.

The British Interplanetary Society has organized a one-day course on rocket-motor technology, for which there will be a registration fee of 10s 6d to cover refreshments. The course will be held from 9.30 a.m. to 5.30 p.m. on March 30, and the location is the new College of Advanced Technology, Gosta Green, Birmingham. The BIS is also planning a symposium on liquid hydrogen, which will be held in the new RAeS lecture theatre in London from 10 a.m. to 5 p.m. on April 28. Non-members will be charged £1 1s.

The West German Aviation Research Society plans to open an institute for space research this year, according to a news agency report from Bonn. The president of the society was reported as saying that the institute would be headed by a German-born American scientist—not from the von Braun group at Huntsville—and would be located in the Bonn-Cologne area. He also said that NASA had offered to co-operate with the institute by equipping an American satellite with instruments or by launching a German satellite.

In a US Defense Department directive on March 8 it was announced that the research, development, testing and engineering of military satellites, anti-satellites, space probes and supporting systems would in future be the responsibility of the Air Force Department. Apart from the Navy's Transit navigation satellite programme and the Army's Advent communications satellite programme, which would continue as at present, the Navy and Army would carry out only the preliminary stages of space technology projects. Exceptions would be made only in unusual circumstances. The Defense Department added that there would be no impingement on the work of the National Aeronautics and Space Administration.

"Flight" photograph

An exhibition of United States Navy research rockets was held at the Science Museum, London, from February 14 to March 10. In this photograph Lt - Cdr Adolphus Jaeger of the Office of Naval Research shows an Arcas sounding rocket to an interested visitor

Missiles and Spaceflight . . .

ROUTE TO VENUS

THIS discussion of the choice of trajectory for the Soviet Venus probe is the second extract from the "Pravda" article "The First Flight to Venus" of February 26. Details of the probe and its associated ground facilities were given last week.

THE speed of the automatic interplanetary station (AIS) relative to the Sun is obtained by combining the speed vector of the Earth relative to the Sun and that of the AIS relative to the Earth. At the moment of exit from the sphere of action of the Earth the speed relative to the Sun was 27.7km/sec. After this the movement of the AIS, just as that of the planets, follows an elliptical orbit with a focus at the centre of the Sun. This orbit has a maximum distance from the Sun (aphelion distance) of 151,000,000km, minimum distance from the Sun (perihelion distance) of 106,000,000km, and inclination to the plane of the ecliptic (i.e., to the plane of the Earth's orbit) of 0.5. The planes of movement of the Earth, Venus, and the AIS are slightly inclined to one another.

In the illustration (right) the movements of the AIS, the Earth and Venus are represented in projection on the plane of the Earth's orbit. The movements of the Earth and of Venus occur along near-circular orbits. Simultaneous positions of the Earth, Venus and the AIS are joined by straight lines. At the start of the movement around the Sun the rocket lags behind the Earth. Shortly before the day of the spring equinox the Sun, AIS and Earth will be approximately in a straight line. After that the rocket will overtake the Earth in angular motion around the Sun. The distance from the Earth to the AIS during the entire flight to Venus will increase continuously and at the time of approach will be 70,000,000km.

The angle between the lines from the centre of the Sun to the Earth at the time of starting, and to Venus at the time of approach, is 120°. The duration of flight of the AIS to its approach to Venus will be slightly over three months. The approach to Venus will occur on May 19-20, 1961.

Venus, like the Earth, has a sphere of action (radius 600,000km). Inside this sphere the influence of Venus on motion is greater than the influence of the Sun. Movement relative to Venus inside her sphere of action will occur along a near-hyperbolic trajectory with focus at the centre of Venus. . . .

Choice of Trajectory

In order to effect a flight to Venus, it is necessary to choose a flight trajectory satisfying a series of conditions. If the date of the launch of the rocket and the date of the approach of the AIS to Venus are given, then the orbit of the AIS in the solar system, outside the sphere of action of the Earth, is uniquely determined. In this event the AIS, leaving the sphere of action of the Earth, must have a velocity fully determined in both magnitude and direction. With unsuitable selection of the dates of launch and approach, however, the required speed will be so large that the dispatch of even a very light AIS would be unattainable with the help of the most powerful rockets technically possible. Therefore the dates of launch and approach are so chosen that the required speed of exit of the AIS from the sphere of action of the Earth should be as small as possible. In this case the speed which the carrier rocket must impart to the AIS during the acceleration period will also be minimal.

The method of acceleration of the AIS by the carrier rocket has an essential significance. With continuous functioning of all stages of the rocket, the useful payload depends not only on the speed which must be imparted to the AIS at the end of the acceleration period, but also on the angle of inclination. With large angles of inclination the Earth's gravity impedes the acceleration. For this reason the speed is more easily imparted in the horizontal direction, whereas large angles of inclination may lead to wasteful expenditure of fuel, and large reductions in the weight of the automatic interplanetary station. For the AIS to leave the sphere of action of the Earth in the correct direction, assuming uninterrupted acceleration, a sharply inclined velocity at the end of the acceleration period may be required.

It is possible to avoid this if the technique of acceleration with intermediate exit into satellite orbit is applied. A satellite carrying the cosmic rocket is placed in a circular orbit by the carrier rocket with minimal losses. The acceleration of the cosmic rocket, starting from the satellite, occurs virtually in the horizontal direction. Having chosen an appropriate plane of orbit of the satellite, and the place and time of the launch from the satellite, the exit of the AIS from the Earth's sphere of action in the required direction can be ensured . . .

As mentioned, dates of launch and approach to Venus are selected so that the exit speed of the AIS from the sphere of action of the Earth should be as small as possible. This determines a series of ranges of dates which are advantageous from the viewpoint of rocket dynamics. Acceptable launch-dates fall within a period of one to two months and are repeated at intervals of approximately 19 months . . .

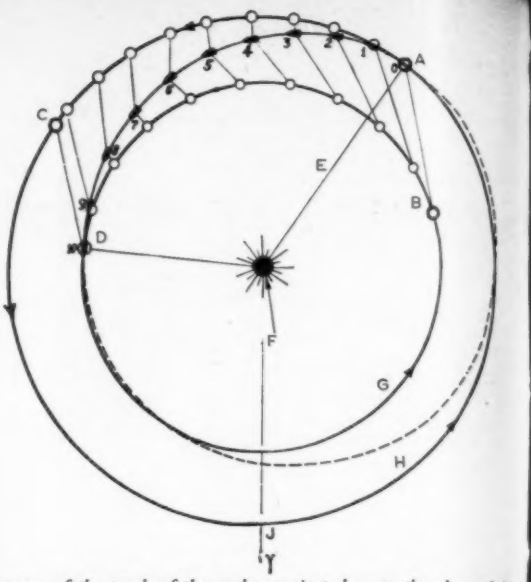


Diagram of the track of the probe, projected on to the plane of the Earth's orbit. A, Earth at time of launch; B, Venus at time of launch; C, Earth at approach of probe to Venus; D, Venus at approach of probe; E, Line of apsides of orbit of probe; F, Sun. The numbered positions are identified in the table below

Position and date		Distance of AIS (km × 1m) from Earth	from Venus	from Sun	Right ascn. (hr) (min)	Decln.
(1)	Feb 22	3.4	74	145	0 27	−1.0
(2)	Mar 4	6.9	60	142	0 22	−1.5
(3)	Mar 14	11	48	138	0 16	−2.0
(4)	Mar 24	15	36	134	0 10	−2.25
(5)	Apr 3	21	27	129	0 08	−2.25
(6)	Apr 13	28	19	124	0 10	−1.25
(7)	Apr 23	37	13	119	0 18	0.0
(8)	May 3	47	7.5	115	0 32	2.0
(9)	May 13	59	3.1	111	0 51	4.5
(10)	May 19-20	70	>0.1	109	1 09	6.5

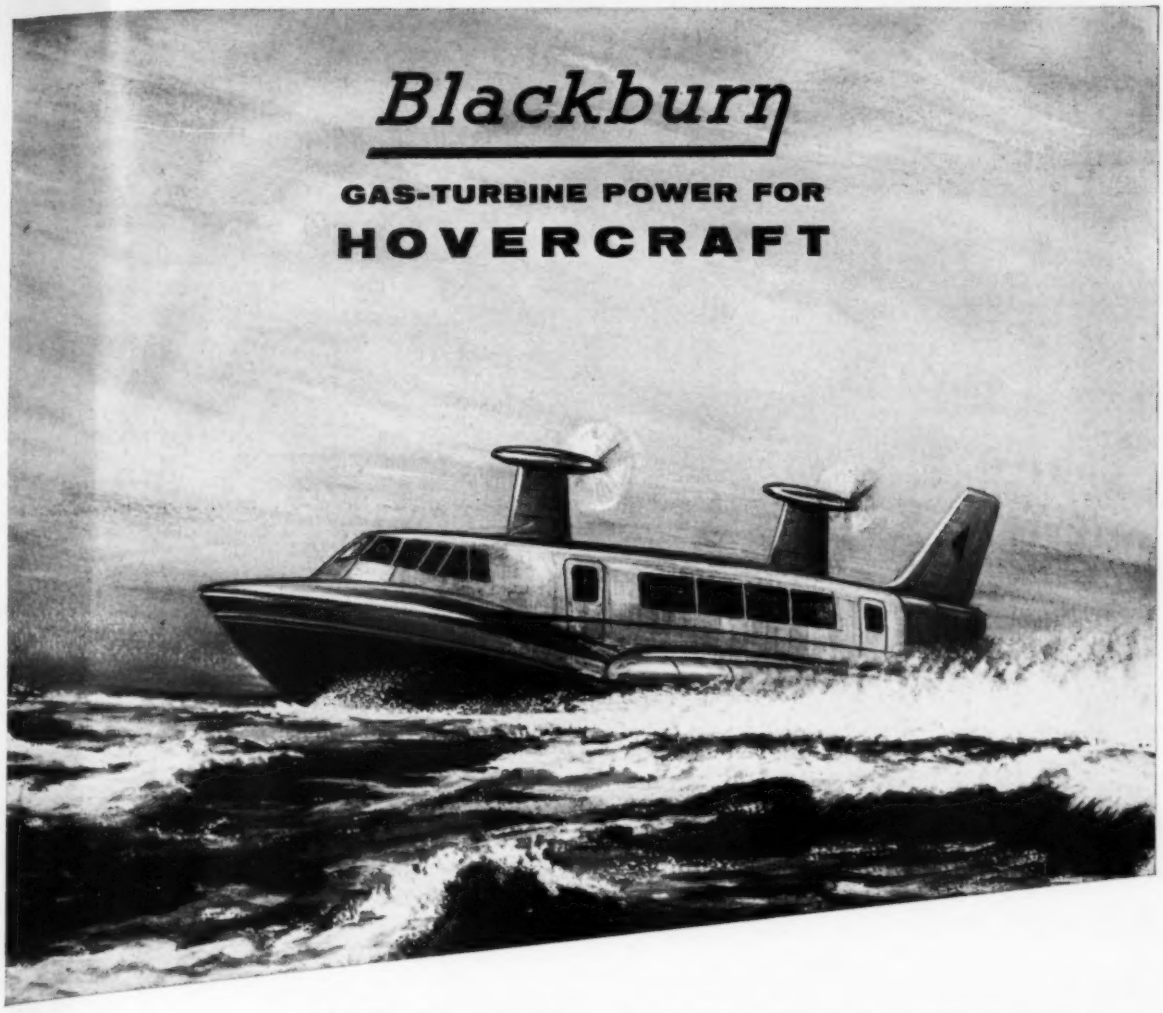
Away from the sphere of action of the Earth the AIS goes into an elliptical orbit of periodic movement around the Sun. The time of flight to Venus may vary greatly for various trajectories which are advantageous in respect of energy. On some flight trajectories the meeting of the AIS with Venus occurs during the first half of the revolution of the AIS around the Sun, on others during the second half, and so on.

For the Febrary 12 launch a trajectory was chosen in which this meeting occurs on the first half of the revolution. Any other type of trajectory has by comparison certain disadvantages: the time of flight is substantially increased and the dependence on the deviation of the AIS at Venus on errors at the end of the acceleration period is substantially increased. Besides this, the distance from Earth to Venus at the time of the approach to the planet will, as a rule, be significantly greater for these trajectories than in the case chosen.

For the AIS to pass very near to the planet, it must be placed on the calculated trajectory with a high degree of accuracy. With only very small deviations in the speed imparted to the AIS, it would fly past at a significant distance from the planet. Errors in the speed of 1-3m/sec (compared with a total speed of over 11,000m/sec), and errors in direction of 0.1-0.3°, would cause a change in the minimum approach distance of the AIS from Venus of 100,000km. This order of deviation is given also by an error of one minute in the launching time.

Trajectory deviations are also able to occur because of the fact that the position of Venus is known only within a certain accuracy. In the calculation of the deviation of the orbit of the AIS from Venus, therefore, there may be errors which exceed even the radius of the planet. The fundamental origin of this error is the inadequate accuracy for this purpose in the measurement of the astronomical unit (mean distance from the Earth to the Sun) which determines the scale of the solar system.

More-accurate knowledge of the astronomical unit is extremely important for cosmic flights. For the above reasons, very exact measurements of the trajectory of the flight are necessary, and also the possibility of small corrections of the movement during the flight to the planet with the aid of special devices, to ensure that the cosmic apparatus reaches the planet.



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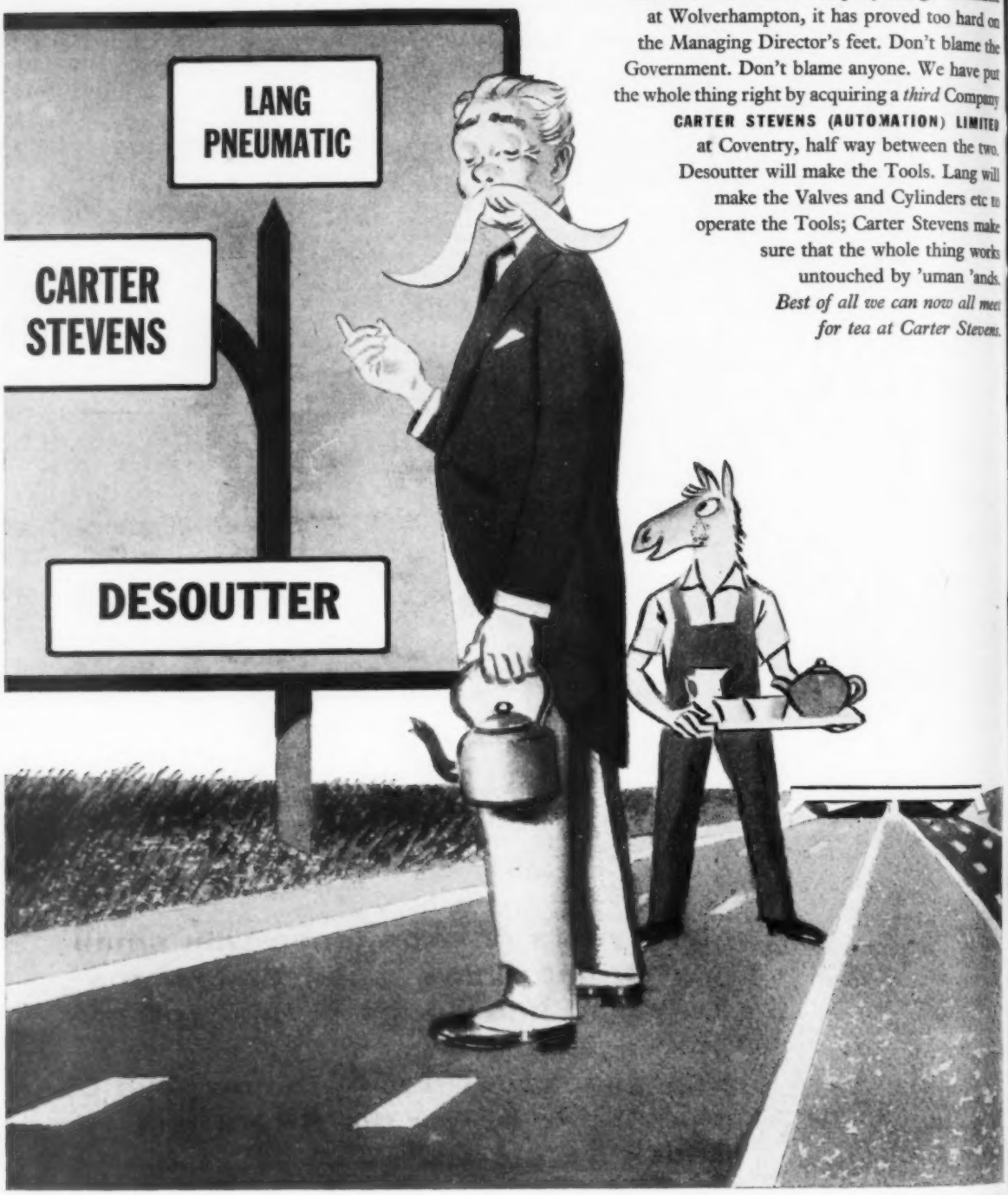
It turns out that the M1 was a mistake—well meant but a mistake. Originally designed to facilitate the delivery of tea from Desoutter at Hendon to their other company Lang Pneumatic at Wolverhampton, it has proved too hard on the Managing Director's feet. Don't blame the Government. Don't blame anyone. We have put the whole thing right by acquiring a *third* Company

CARTER STEVENS (AUTOMATION) LIMITED

at Coventry, half way between the two. Desoutter will make the Tools. Lang will make the Valves and Cylinders etc to operate the Tools; Carter Stevens make sure that the whole thing works untouched by 'uman 'ands.

Best of all we can now all meet for tea at Carter Stevens.



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"Turns at M0.8 are made wholly on the ailerons . . . the aircraft flies itself, wherever it is placed on the attitude director." (Picture by the author)

A Taste of the Talon

BY ROBERT D. ARCHER, ARAES

AS WE levelled off at 45,000ft I was able to see the Palmdale Air Force facility from which we had departed a scant four minutes previously. We accelerated to Mach 1.24; then the pilot, over the intercom, said "Notice the deceleration when I cut the afterburners." We slowed sharply; thus, from the very beginning of our flight, Northrop's T-38 Talon had impressed its personality most strongly on me.

I had been asked to take a check ride in the US Air Force's latest trainer, flying from the assembly area of Northrop's Norair division at Palmdale, California. Early in the morning, the sun was up high and bright, the atmosphere sparklingly clear. I sorted out my equipment and proceeded to get ready for the flight with company test pilot Hank Chouteau. We changed into our flying equipment and waited while the ground crew readied the aircraft. Hank explained some details of the flight, and procedures to be followed; meanwhile the crew chief reported that the aircraft was ready and the fuel topped up, giving us a take-off weight of 11,631lb. We walked out to the ramp and I thought how inviting the slender, racy lines of TF-603 looked. The aircraft was the 16th produced by Norair and the first production T-38A-20, serial number 59-1603. It was painted in gloss white with broad bands of fluorescent red on the wings, fuselage and empennage.

As we walked round the aircraft, Hank explained such points of interest as the liquid-oxygen system for the crew, the wide-track landing gear, the external oil-level sight gauges for the hydraulic system, and the ease of accessibility from the ground. At the rear we came across a new feature. Between the two nozzles from the General Electric J85-5 afterburners there was a fitting best described as a saddle fairing. Hank explained that there had been a small, but disconcerting, buffet—noticeable only at military power—which was finally traced to the airflow between the two nozzles. The saddle fairing, which had completely cured it, appeared to be the only aerodynamic modification to the aircraft since its first appearance in 1958.

I was to fly in the instructor's cockpit, so climbed up the rear ladder and settled into the ejection seat. Hank helped me to strap in with the shoulder harness, automatic delayed-action lap-belt and parachute lanyard. The shoulder harness is coupled to an inertia reel, locked by a lever on the left side of the seat; seat height is controlled by an electric switch on the right side. Next, the use of the radio and intercom system was described, together with the panel layout. This was the first time that I had flown with the integrated instrument panel, in which the attitude director replaces the artificial horizon, ball and turn indicator and rate of turn. This new instrument uses a gyro, having 360° of freedom in all three axes, the two hemispheres of which are painted in light and dark grey to indicate the sky and earth relative to the fixed replica of the aeroplane in the centre.

Below the attitude director was the multiple air-navigation indicator. This contains a compass card, heading marker, course arrow, course deviation bar, bearing pointer, to-from arrow, course and heading set knobs and bearing and distance displays. The heading marker and course arrow indicate the selected heading and course, and the bearing pointer indicates bearing to a selected Tacan station. The course arrow indicates selected Tacan or computed course, while the centre portion of the course arrow is a moving course deviation bar representing the desired flight-path. Position of this bar relative to the fixed replica of the aircraft at the centre shows displacement to right or left of the selected course. This course is presented on a moving card within the compass card, and shows aircraft plan position relative to the desired course. On the left side of the panel were the airspeed and Mach indicator, accelerometer, navigation mode selector switch and clock. On the right were the altimeter, rate of climb, and the engine instruments:

". . . chocks away and applied 75 per cent r.p.m. to start taxying. Flaps were then set at the 45 per cent position"

A Taste of the Talon...

per cent r.p.m., oil pressure, tailpipe temperature, nozzle position, fuel flow and fuel remaining. The layout was very neat and uncluttered.

After I had plugged into the oxygen system and checked that it was working correctly, Hank adjusted the rudder pedals for me. Pulling out a handle attached to a cable in the centre of the console allows the pedals to come aft; releasing the cable then locks them in the desired position. Ejection procedure was explained next, although it was comforting to know that in over 2,000hr of test flying with the T-38 there has never been any need to make use of it. Ejection procedure is simple—pull the feet back against the seat, elbows into the guards, pull the seat arms up, and pull either of the two triggers exposed. The seat fires 0.3sec after the canopy, and can be used at ground level. A canopy breaker is provided above the seat in case the canopy fails to jettison.

Satisfied that I was ready, Hank then proceeded to climb into the front cockpit, which is normally occupied by the student. Both cockpits are identical, apart from certain air-conditioning and pressurization controls which are located in the front cockpit only. The interior is extremely roomy and very clean, and I had ample room for my cameras and equipment. Looking forward I could just see the top of Hank's head, and the forward view from the rear cockpit was superb.

Hank started the right engine; when the r.p.m. reached 10 per cent from the ground air supply, the throttle was set to the idle position (47 per cent r.p.m.). The left engine was then started and the ground hose disconnected. After checking speed brakes, flight controls and the flight-trim switch, the pilot waved the chocks away and applied 75 per cent r.p.m. to start taxying. Flaps were set at the 45 per cent position (100 per cent movement is 44°) and we turned through 180° on to the taxi strip.

Hank had received permission to take off on Runway 22, 7,000ft distant, and he said "OK, now you steer her out." I found the Talon easy to steer by the nosewheel, though the pedal force required was a little on the high side. As we taxied out, he asked me to check the rear canopy, which is counterbalanced and manually operated. Satisfied that both canopies were operating and locked correctly, Hank said "I will show you how fast we can accelerate the engines on the ground." First the left J85, and then the right-hand engine was opened up from 47 per cent, each taking 5sec to reach military power.

The Take-off

I had already found that the intercom was by far the clearest I had ever used, a particularly good point for a trainer. Eventually we arrived at the end of the runway, and lined up with its 12,000ft stretched in front of us. The flight-trim switch was actuated to set the horizontal stabilizer [tailplane—Ed] in the take-off position; full military power was applied with the brakes on, and as the brakes came off both afterburners were cut in. The resulting acceleration was phenomenal, for production J85-5 engines are now producing nearly 4,000lb with afterburning. Nosewheel steering was disengaged as the rudder became effective at 70kt, and with a backward pull on the stick at 135kt we lifted off at about the 2,300ft mark, retracting the gear immediately, followed by the flaps, so as not to exceed the limiting speeds (240kt for gear and 300kt for flaps). No trim change was noticeable in either case.

Hank held the Talon down at about 60ft and let it gather speed until we were doing 450kt at the end of the runway. The stick came back for a 2g pull-up, and we climbed at about 50° straight up to 45,000ft. The Machmeter read over 0.9 during the climb, and the initial rate of climb was greater than 30,000ft/min. This rate of climb is exceptional for a trainer, and should help pilots to accustom themselves to modern fighter performance. As mentioned in the first paragraph, we went supersonic at 45,000ft, and then decelerated with afterburners off. Thanks to the efficiency of the cabin conditioning, we were comfortably warm and, with the 5 lb/sq in pressure differential, breathing was comparatively easy.

Hank declared "I'll show you how she rolls," and he pushed the stick over for a left roll at about 200°/sec. The nose went round smoothly with no roll-coupling or deviation from the line of flight. He then said: "OK, you can now fly her down to 36,000ft and turn to the east." I found the aircraft response extremely positive, but without any apparent pilot-induced oscillations. Turns at M0.8 are made wholly on the ailerons, and the aircraft flies itself wherever it is placed on the attitude director. The low fuel consumption was pointed out to me, fuel flow being about 700 lb/hr to each engine.

After we had descended to 36,000ft, Hank announced "OK, now we'll see how she accelerates straight and level," and applied max power. Slightly slowly at first, then really beginning to wind up at about M0.94, we slipped past M1 with only the needle to show that it had happened. There was no change in trim, feel of the stick or cabin noise. We accelerated up to M1.25, well past the guaranteed specification figure of 1.22; then it was afterburners off, power back,

"The instrument panel layout . . . with the new integrated instruments . . . was very neat and uncluttered"

variable-position speed brakes full down (50 per cent), and we slowed to 200kt and cut the left engine. Hank warned "I am going to drop the landing gear with the manual handle" (alternate system on the left upper side of the panel). The gear came down and locked—right, left, then nose—and the noise level rose considerably. Then, with left engine windmilling, its hydraulic pump supplying the pressure for the landing-gear and utility systems, "gear up" was selected. All units came up and locked quickly, despite the fact that we only had windmilling pressure. Very noticeable was the almost complete absence of any directional trim change, or of any alteration in control feel. Hydraulic pressure from either engine will operate all controls normally, a considerable safety feature.

We had flown through some clear air turbulence at 36,000ft, and looking aft at the small wings noticed that they shivered slightly, with a barely noticeable shake in the cockpit. Visibility aft is extremely good; one can see almost the whole of either wing. We then dived to 12,000ft and circled over the northern part of Mojave, in the desert, and received permission to make a practice ILS touch-and-go to check some of the instrumentation, as this was only TF-603's fourth flight.

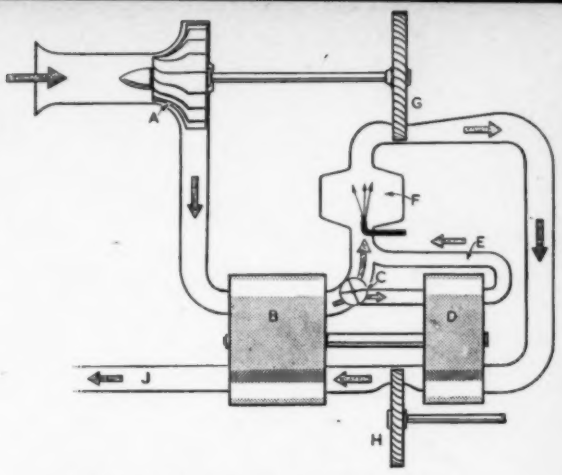
Coming straight in to Palmdale the high rate of sink with flaps down was very noticeable, again simulating modern fighters. Gear was lowered at 200kt and there was again an immediate increase in noise. At 175kt buffeting began, due to gear extension and full flap, and became quite noticeable (but not unacceptably so) at 155kt over the fence. Gear was then selected up, and we accelerated away. Engine response was extremely fast, and we were soon at 12,000ft again.

Although we had been airborne for over 40 min, we still had 500lb of fuel on each side. But time was pressing, and we came in again, this time making a normal traffic approach at 350kt, and using the speed brakes to slow us to 240. Landing gear was selected down, and flaps lowered to 45 per cent. We turned on to final at 170kt and lowered flaps to 100 per cent. We crossed the fence at 150kt this time, and touched at 135kt with the nose held up. We touched right wheel first, and the stiff leg smoothly absorbed the high rate of sink. The advantage of the wide track became obvious as the aircraft set down very firmly. Braking was even and smooth, and our roll was about 3,000ft. We then retracted flaps, taxied in and opened the canopies. I restored the seat safety pin, and its companion for the canopy-jettison handle, unhooked my mask and tried to summarize my experience.

Briefly, the outstanding features are the astonishing acceleration and fantastic rate of climb, exceptional handling qualities throughout the speed range, wonderful visibility and safety. All-in-all, a remarkable little aeroplane representing, in my opinion, a genuine breakthrough in the aerodynamic art. The T-38 seems assured of a long service life in the US Air Force; and could well become a best-seller abroad, as it makes an ideal stepping-stone to current M2 aircraft.

BETTER SMALL TURBINES

SOME THOUGHTS BY THE TECHNICAL EDITOR



Suggested circuit diagram for a small engine incorporating Pouit's by-pass and Holmquist's heat-exchanger: A, compressor (15°C in, 115°C out); B, first heat-exchanger (500°C exhaust); C, by-pass valve (480°C); D, second heat-exchanger; E, by-pass duct; F, combustion chamber; G, compressor turbine (800°C); H, power turbine; J, exhaust (135°C)

DURING the past 20 years there has been some justification for the feeling that all turboshaft engines tend to fall into one of two clearly defined categories. Those for aircraft use have been designed ever more boldly, by adopting the highest possible pressure ratio and turbine entry temperature. Thus—without any modification to the basic thermodynamic cycle—engines such as the Tyne can demonstrate specific fuel consumption better than that of nearly all piston engines, not excepting even diesels. In contrast, non-aeronautical turbines appear to have been designed to ridiculously unambitious pressures and temperatures, so that their performance has been fundamentally uninspiring, even when the thermodynamic cycle has been improved by all sorts of intermediate heating and cooling. It is surely for this reason primarily that the gas turbine has so far failed to win a place as a prime mover outside the field of aviation.

The accompanying pictures illustrate some ideas which may go a long way towards remedying the competitive performance of otherwise unambitious gas turbines; and they look particularly promising for small engines. No engineer working in this field needs to be reminded of the manifold shortcomings of the heat exchangers so far developed in an attempt to bring down the s.f.c. of small turboshaft engines intended for automotive applications, where efficiency under part-load conditions is of the first importance. Engineers in France and Sweden have evolved improved hardware for a working cycle which appears likely to live up to the encouraging claims being made for it. There are really three ideas involved; the Pouit by-pass turbine, the Holmquist heat-exchanger and the SODIM turbine wheel.

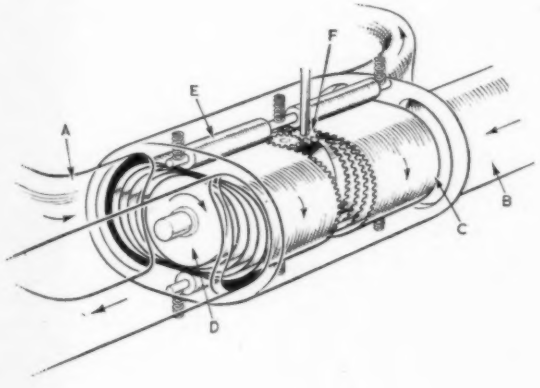
Pouit's By-pass Future gas turbines intended for extensive part-load running may be expected to have an "inner heat pump" evolved by the Frenchman Robert Pouit. Under small and varying conditions of output torque, any desired proportion of the combustion air is automatically by-passed through a second heat exchanger, so that the compressor turbine can work in an approximately constant gas temperature. The claim is made that, between 40 per cent and 100 per cent power, the compressor-turbine entry temperature can be held at 800°C and the s.f.c. maintained at 165gm/hr/CV, equivalent to 0.369lb/hr/s.h.p. The need for a by-pass line of this type is essential in surface applications involving extensive running at low loads, but may not be worth while in light aircraft, which can readily be designed to cruise continuously at over 70 per cent power.

Holmquist's Heat Exchanger Ernst Holmquist of Gothenburg is a specialist in heat-transfer. His heat exchanger overcomes most of the crippling handicaps which have made such devices excellent things not to have in an aircraft gas turbine. To the writer's knowledge, the Bristol Theseus was the only aircraft gas turbine to incorporate a heat exchanger; and it was dispensed with before the engine flew. Holmquist's idea may well bring such devices back into favour, particularly in relatively small engines in which high cycle-efficiency is very difficult to achieve.

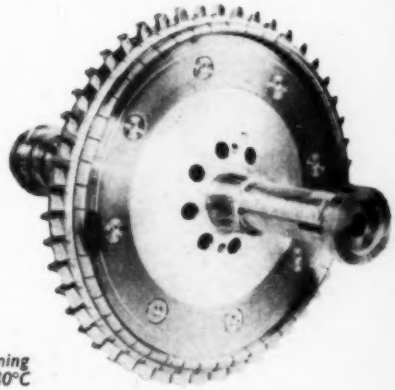
The basic idea is wonderfully simple. The medium for heat transfer is a stack of 100 or more belts or sleeves made of very thin stainless-steel sheet. As the perspective sketch shows, the belts are of steadily increasing diameter, the increment being one or two millimetres. The concentric stack of sleeves is wrapped round a central drum, with a diameter slightly less than that of the smallest sleeve, and held tightly at top and bottom by outer rollers. This deforms the sleeves to an oblate form, with maximum separation between adjacent sheets on either side. One side is placed in the intake and the other in the exhaust, and the complete stack of belts is driven at any desired speed (by a toothed wheel, it is suggested, engaging in teeth cut along the edges of the bands).

Advantages of this arrangement are its low weight and bulk, the fact that spacing between the bands can be extremely fine without incurring excessive pressure-drop in the gas flow and, above all, the elimination of gas leakage. The latter is prevented by the fact that the thin sheets enter and leave the gas ducts compressed to a solid pack, passing through sliding fits in graphite-lined slots lubricated by oil mist. Development problems do not appear to be insuperable; obvious queries concern component life, and in particular the behaviour of the thin belts under conditions of corrosion, or with ingested particles (which could be hard or abrasive) in the gas stream. The concept has at least attracted the attention of such renowned companies as Rover in Britain, Hispano-Suiza in France and Chrysler in the USA; and Hispano in Paris are actually about to run a 100hr endurance test with a Holmquist heat exchanger, with Inconel belts, for a 13,000 h.p. gas-turbine locomotive on order for the SNCF (French State Railways).

SODIM'S turbine It is appropriate to bring into this dissertation a brief reference to the turbine rotor developed by SODIM, a French company for the practical evaluation of new inventions. The typical example illustrated in the photograph consists of two discs bolted together to clamp 48 stumpy blades around their periphery. Cooling air is fed through the drive shaft and escapes between the discs and out through holes in the blades. Each blade is sintered in 87 per cent aluminium and 13 per cent aluminium oxide, weighs about 0.18oz and costs 1s 6d. The turbine shown, from a 120 s.h.p. automotive engine, runs at only 12,500 r.p.m. and blade temperature does not rise above 450°C in a gas temperature of 800°C. This particular wheel has run 1,000hr on a fuel containing 1 per cent sulphur and 0.07 per cent vanadium, both of which are viciously corrosive on hot steel. Last year SNECMA began investigation into light and cheap wheels of this nature.



Left, schematic diagram of a pair of Holmquist heat-exchangers in series: A, intake duct; B, exhaust duct; C, stack of moving belts (only a few are shown, for clarity); D, central roller; E, pressure rollers; F, drive pinion



The SODIM turbine wheel after running 1,000hr in a corrosive gas at 800°C

"Flight" photograph

Are Britain's airports the most expensive in the world?

Landing Fees—Plus

By G. L. MARCHAULT

BEFORE attempting any survey of airport charges it is imperative to eradicate two widely held fallacies. The first is that all the operator has to pay is the appropriate landing fee. In many cases nothing could be further from the truth. It is simply not enough to quote the landing fee and leave it at that. Honolulu has the lowest landing fee, for a Boeing 707-320, of any airport in the world—a mere 14s 3d, but there is a State tax of 3½ cents per US gallon and a local tax of 3½ per cent on the basic cost of the fuel, neither of which is refundable. This means that the total bill presented for a Boeing which has uplifted 14,000gal of fuel is in the region of £246, which makes the 14s 3d landing fee slightly irrelevant.

The second, and even more widely held, fallacy is that the fees at London are the highest in the world. This has been stated so often by so many people, some of whom should know better, that one could be forgiven for believing it. Among the 40 countries listed in the accompanying charts there are no fewer than seven charging higher fees, and some of these overtop the London charges by a considerable margin.

Airports are very expensive to operate and maintain but they alone are not sufficient for the needs of air transport. Behind the scenes there has to be an adequate system of navigational aids, a vast telecommunications network and air traffic control and meteorological services working around the clock. In addition there are various ancillary services. The sole purpose of this entire organization is to further safety, regularity and efficiency of air transport. That being so, it is reasonable that air transport operators should pay their share.

But this idea appears to be most unpopular with the airlines. In November 1960 the UK general manager of a major foreign airline said, *inter alia*: "It is apparently felt that the national corporations and foreign airlines should be called upon to meet the

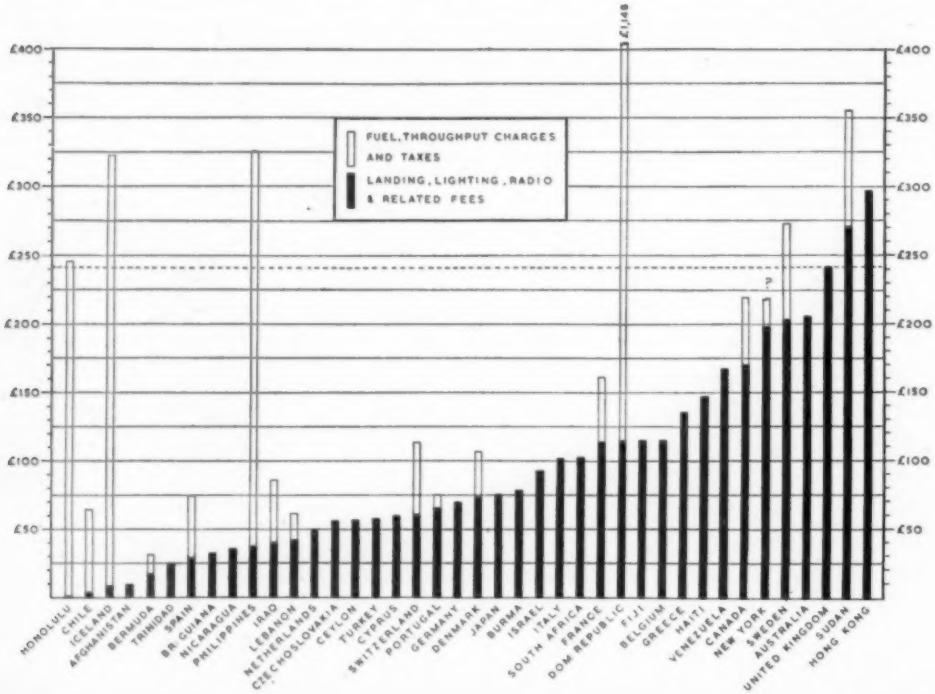


Fig 1. Typical charges for a Boeing 707-320 at airports of 40 countries

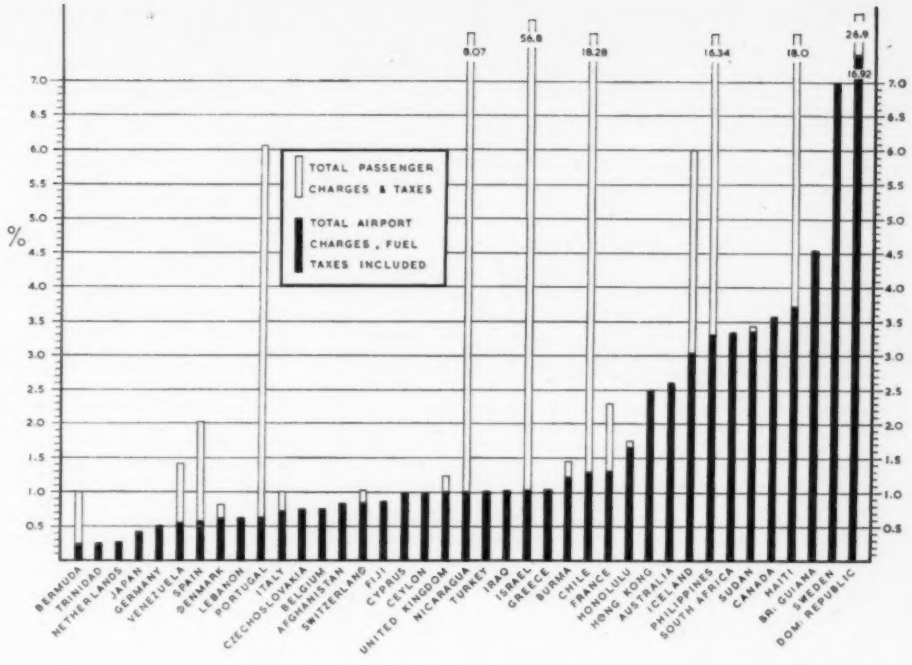


Fig 2. Charges as a percentage of gross revenue

losses on the operation of the UK aerodromes, without taking into account the community benefits arising from the existence of airports in the country, particularly international airports. In my humble opinion the Government should absorb a large proportion of the costs, because of the benefits derived. It has to be realized that most of the airlines are already operating with the narrowest of profit margins and for some of us these increased landing charges may mean the difference between profit and loss. The airlines are very sensitive to cost increases and particularly to those beyond their control, because they are in a critical state of development with the introduction of jet aircraft. . . ."

This extract is fully representative of the line which has been taken by almost every airline senior executive, and by IATA, in recent months. But not one of them has been realistic enough to admit that the airlines are directly responsible for the increased fees. They fell over themselves to buy the new jets, replanned their schedules in feverish competition with each other to offer increased capacity and then, when the novelty had worn off, found in some cases that they had over-estimated demand, under-estimated costs and run into financial difficulties. Now, having made it necessary for almost every country throughout the world to increase the size of its airports and augment its navigational aids, they find to their amazement that some of these countries are being mercenary enough to try to recoup some of the money which the airlines have forced them to spend. It is then that they talk about "community benefits" and try to convey the impression that they are being penalized in their attempts to bring tourists into the country. They also maintain that their efforts to reduce fares are being hindered.

Published methods which administrations employ to get back some of their money are shown in the accompanying charts, which are based on a complete revision of the tables* and charts published in *Flight* for April 17, 1959—but with one major addition. This time fuel "throughput charges" and non-refundable fuel taxes have been included. There was insufficient information in 1959 for a representative picture to be given. Brief notes on the various types of charges in use may help to clarify both the charts and, when they appear later (see footnote below), the tables:—

Landing fees These are usually based on unit cost per ton (long, short or tonne metric), or per 1,000lb or by weight brackets. An exception is Portugal, which uses horse-power as the basis. Fees frequently differentiate between domestic, continental and intercontinental traffic.

Overflying charges In general these are raised against an aircraft which makes use of facilities within a country or along a route. Shannon was a pioneer of this system, but here the operator faces an unknown factor. The individual charge is based on the monthly cost of running the station divided by the number of contacts made during the month. That is reasonable so long as there is plenty of traffic, but it could be a little hard on an operator if one of his aircraft was the only one to make a contact during the month. Because of this unknown factor the entry in the table for Ireland will be incomplete. Malta charges £2 for a similar service.

Air navigation charges These are usually an addition to a landing fee, or a combination of overflying charge and navigation charge, or—as in the case of Australia—a combination of all three. The various routes within Australia are listed and to each is allotted a "flight factor." The aircraft pays a fee at the rate of so many pence per thousand pounds of aircraft weight multiplied by the flight factor. Canada has a particularly heavy charge; in addition to a telecommunications fee of $20 there is a route facilities charge of $64 for a landing after, or take-off before, a flight crossing the Atlantic, Pacific, Caribbean or polar regions. Thus a round trip London-Montreal-London would pay the double charge at Montreal.

Chile uses a scheme based on charges for radio beacons plus a communications charge, based on aircraft weight, for every mile flown, plus surcharges for night flights. They have an additional charge which others might consider—an hourly charge for calling search and rescue units into operation because of failure to notify flight plan changes. There is a brighter side—all Chilean flying club and pleasure aircraft are exempt from all charges.

Mexico raises charges for navigational aids, meteorology, air traffic control, and so forth; once again the entry in the tables will be necessarily incomplete.

Passenger service and/or cargo handling charges These are too well known to call for comment. The highest fee appears to be £1 per head at Bermuda.

Ticket taxes These are gaining in popularity (with governments) and increasing in severity. They take the form either of a fixed-value stamp tax on every ticket sold or a percentage levied on the price of the ticket, or both. Airport departure fees, as distinct from service charges, are also included under this heading. The most oppressive rate of tax appears to be levied in Israel, where the levy on locally purchased tickets for residents is 55 per cent. Having arrived in Israel one would seem to have a strong inducement to stay there. Peru takes 4 per cent on all tickets bought locally for destinations abroad, plus 4 per cent airport tax on tickets for abroad, plus 2 per cent tourist tax for international flights starting from Peru and 10 per cent domestic travel tax on tickets wherever issued or paid for.

Fuel throughput charges and fuel taxes Fuel throughput charges are a direct levy on the operator in respect of every gallon of fuel, or oil, supplied. The proceeds go, usually, to the airport administration. Some countries publish their throughput charges quite openly and one then knows where one stands. Others publish nothing and conceal them within the airport fuel concession contract.

* *The new tables will, it is hoped, be included in "Flight's" "World Airlines Survey" on April 13, 1961.*

Landing Fees—Plus . . .

The fuel supplier then pays a levy direct to the airport administration, passes this on to the customer in the bulk price and it becomes impossible to determine by how much the basic price of the fuel has been increased. One suspects that this happens at New York. In any case it has proved impossible to obtain figures for fuel prices inside the United States or in Hawaii and so it is extremely difficult to calculate the amount of tax to be paid where applicable. We have been forced to assume prices for these locations based upon the tax-free prices at London (100 octane—2s 2¾d per gal, kerosene—1s 6¼d per gal).

Fuel taxes usually accrue to the country (or state or city) and can alter the picture considerably. Whereas Iceland has a very modest fee of £8 13s 3d for landing a Boeing 707-320, the final bill is hoisted to £331 16s 7d if a full fuel-load is taken on. Similarly the American landing fees look relatively small until one takes account of fuel charges, and then the picture is vastly different.

The diagram at Fig 1 illustrates clearly how misleading it can be to think solely in relation to landing fees for airport charges. In this representation the solid columns include only the charges payable by the operator in respect of landing fees, lighting, navigational aids, etc., for a Boeing 707-320 with fuel-throughput charges and non-refundable fuel taxes superimposed. It is immediately apparent that although UK has landing fees which are the third highest among the countries considered, she slips down the league table when the fuel levies are aggregated with landing fees.

Head taxes, entry or transit charges These are administrative devices calculated to make the traveller realize how fortunate he is to be allowed to set foot in the country, ranging from 3s per head in Burma to £4 9s 4d in the Philippines and £5 in Jeddah.

Fig 2 attempts to illustrate the approximate yield which countries try to extract from civil aviation. For each country the timetables were searched to find the longest non-stop flight normally made from that country and the type of aircraft used. Then, using a 60 per cent load factor and assuming 30 first-class and 70 tourist-class passengers for a Boeing, the operator's gross revenue was calculated. The solid columns represent the gross charges payable by the operator, i.e., those included in Fig 1, as a percentage of his gross revenue. The open columns superimposed represent the gross amount received by the country, namely the fees paid by the operator together with all the stamp duties, ticket taxes and passenger service charges and so on paid by the passenger. The basis of the computations is a flight from the most distant (non-stop) destination to the country considered and then a return flight back to the other end—though only the charges at this end have been considered. This is to take account of countries like Israel, which charge for passengers both inbound and outbound, and Canada, which charges the full transatlantic fee for both take-off and landing on such a flight.

The United Kingdom Problem

The basic problem facing the financial experts in the Ministry of Aviation is just how to find all, or part, of the £3,900,000 which was lost last year on the 11 aerodromes which, it is intended, shall ultimately be self-supporting. Due to the extreme difficulty of allocating costs it is possible that even this figure does not represent the full total which could be attributed to national and international aviation at these airports (*Flight*, January 27, p. 105).

However, using the published figure for the purposes of discussion, how is the money to be found? One way to find more revenues is to increase landing fees and this, to a tune of around 33 per cent, will happen on April 1. This decision has provoked shrill and angry protests from the airlines and ill informed and inaccurate comment in other places. Oddly enough, increases elsewhere appear to have passed without protest. Cyprus, France, Greece, Hong Kong, Israel and Switzerland have all raised their fees within the past two years; and, whilst as from November last a Boeing 707-320 ex-Melbourne and clearing Darwin for Singapore now pays £A260, an increase of nearly 80 per cent, Venezuela has topped the lot with an increase of 100 per cent.

The official IATA line of reasoning on landing fees is astounding. In their condemnation of the new UK figures, issued a few weeks ago, they say: "Because of the government's inherent responsibility for the public safety, technical services must remain under direct government control and supervision and it is considered only proper that the costs of such services at airports should be assumed by governments." That may seem proper to IATA, but it must seem most improper to the taxpayer.

Let us, for the sake of argument, concede that the airlines have now reached the point at which they will prefer to overfly or curtail services to the UK in preference to paying more, and see whether any other sources of revenue are available. Airport concessions and car parks are already under active consideration, and much can be done in these respects. Is there any logical reason why air travel should not also pay tax? At any rate it would make far better sense than the present system under which the taxpayer stands the loss on airports and so, in effect, makes a present of a *per capita* subsidy to every air traveller entering or leaving this country. Leave the passenger service charge out of it because this does not apply to incoming passengers or transits, and it in any case only diminishes the subsidy very slightly—it does not expunge it.

A tax of 1 per cent on all tickets sold in this country would add a negligible amount to the fare paid by the passenger; a tourist ticket to Rome next month would cost £38 10s 9d instead of £38 4s (night rate). The tax should not be restricted to nationals: let the foreigner join in as well and then we can have some of the National Health expenses back. A 2 per cent ticket tax would make little more impression and would enable landing fees to be cut by a handsome margin. Such a tax would bring in about £242 from a Boeing 707 load arriving at London from New York. By using this expedient the landing fee could be cut by £100, the passenger service charge abolished and the UK airport deficit wiped out in quite a short time. There is little danger that foreigners will complain. This tax is used in France, Iceland, Israel, Italy, Japan, Mexico, Poland, Portugal, Spain and Syria among others, whilst the Americans have paid a 10 per cent transportation tax for years.

* * *

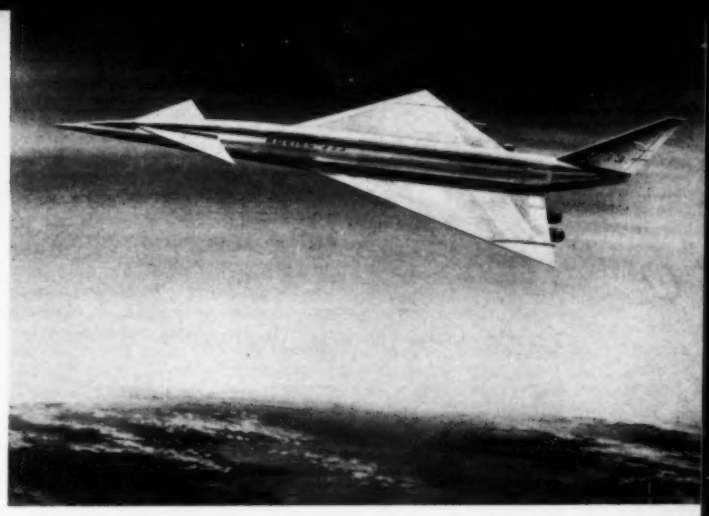
I am indebted to the Shell International Petroleum Company for their assistance in providing the relevant throughput charges and fuel taxes. The Aeronautical Information Service of the Ministry of Aviation were equally helpful in providing the latest information available on landing fees and allied charges. I am emphatically *not* indebted to the inventors of our currency system, which made a mountain of extra work in calculating the figures that went into the charts (and into the tables to be published in a future issue). Decimalization of Britain's currency is long overdue. Apart from the Yemen, which has 40 bakhtas to the riyal, the £ is the only non-decimal currency left in the world.

CIVIL SUPERSONICS: TOO MUCH HURRY?

A PLEA FOR A MORE RATIONAL APPROACH

BY BO LUNDBERG, FRAeS, Hon FIAS

(Director, the Aeronautical Research Institute of Sweden)



THAT the development of the supersonic airliner should take second place to an intensive programme for enhancing the safety and efficiency of subsonic transport was the theme of a paper given by Mr Bo Lundberg, the eminent Swedish authority, at the recent Air Safety Seminar held by the Flight Safety Foundation. Mr Lundberg—whose career started with test piloting and design work 30 years ago—began his lecture by examining two of the major questions of supersonic flight, the sonic-boom problem and its implications for people on the ground, and the cosmic-ray hazard with its possible effects on those in the air.

There is general agreement [said the lecturer] that all technical design and operational problems involved in supersonic commercial aviation—at a Mach number anywhere between 2 and 3.5—can be solved in the near future, even if they are not solved today. The topical question widely discussed is, therefore, *when* this kind of aviation should be introduced.

With regard to two specific problems of a fundamental nature, and which are completely new to civil aviation, I am not yet convinced that they can ever be solved in a way compatible with economic operation. I maintain, therefore, that the first question to be answered concerns not when, but *if* we are to have supersonic aviation.

The two problems are those of sonic booms and cosmic radiation.

In order to indicate the severity of the sonic-boom problem it might be mentioned that a 180-ton Mach 2 or 3 airliner flying at 70,000ft, and presumably carrying some 100 passengers, would sweep the earth's surface with a thunder-like noise along its entire flight-path, the effect being a rattling (and often shattering) of windows and the awakening of sleeping people within a band of disturbance some *70 miles wide*.

Just as Important

Let us imagine the inaugural night-flight from New York to Los Angeles with such an aircraft; supposing that no restrictions in operation are imposed, then several millions of US citizens will be awakened from their sleep and pleasant dreams. Never before in history will have so many been disturbed so much by so few! Is it justifiable that millions of passengers on our spacecraft *Tellus* should be disturbed in this way to enable about 100 passengers flying from New York to Los Angeles to gain a couple of hours in flight time? My answer to this question is "No." Even with the strongest belief in, and enthusiasm for, aviation, I do maintain that people on the ground are as important in all respects as those who are temporarily in the air.

However, this single flight will by no means indicate the severity of the vast problems confronting us. We just have to look far into the future and consider what supersonic aviation will look like many decades from now. Let us be quite clear about two facts: (a) once supersonic aviation has been introduced, it will grow and continue to grow indefinitely—if it is at all an economically sound proposition; (b) once introduced, but ultimately found to be a mistake because of protests of the public, it will not be possible for the airlines to turn back to pure subsonic civil aviation without economic disaster.

One just cannot wake up to a delayed state of common sense and declare that all the huge, sleek and beautiful aircraft, masterpieces of science and engineering, which were bought for several billion dollars, were quite nice to have for a while, but have now become so disliked by the world's population that we had better scrap them all! The point I therefore wish to make is that we have arrived at one of the most important cross-roads in history, not merely for aviation people but for all mankind.

We just cannot—or at least should not—bombard larger and larger portions of the earth's surface with ever-increasing sonic-boom thunder without giving, in advance, full consideration to all the implications. It might be argued that all means of transportation (railroads, trucks, airports) are noisy. That is true; but the very big difference is that whereas it is physically possible to move away from railways, highways and airports, hundreds of millions of people would never be able to move away from the ever-increasing areas and frequency of sonic-boom thunder. Another significant difference is that sonic bangs are sudden and unexpected, whereas airport noise is of a gradual character which the neighbours can to some extent get used to.

It would, of course, be possible to impose restrictions on supersonic aviation—for instance, limitations to day-time or to over-sea operation. Obviously this would considerably limit the supersonic market, with adverse effects on the economics; yet I doubt whether even with such restrictions supersonic aviation would be justifiable from sociological, medical and legal points of view. People should have a right to enjoy quietness even in day-time. It should even be remembered that quite a few people are dependent on undisturbed sleep during the day, for instance because of work at night.

Furthermore, there will be tremendous legal problems. Who will pay the damages arising from hardships inflicted on people because of decreased sleeping time or from losses on account of reduced working capacity? And can one neglect the possibility of, for instance, people with weak hearts being killed by sudden sharp sonic bangs?

A Matter of Dimensions

For medical and sociological reasons, supersonic aviation—be it by day or night, over sea or over sparsely populated areas—should be permitted only if the operators can guarantee that the sonic booms will be below a specified limit of intensity. This should be so low that light sleepers will normally not be awakened. But in the present state of the art, and in the foreseeable future, such a requirement cannot be satisfied economically, as it would limit the aircraft size to fighter-like dimensions.

The question of the acceptable intensity of sonic booms is, in my opinion, not an issue that should be determined on the basis of number of complaints. Such an attitude could result in concentrating supersonic civil aviation over sparsely populated areas or over sea, because "only," say, hundreds of thousands of people and not tens of millions would then be afflicted. The obvious thing to do is to conduct extensive test flights with existing military supersonic aircraft in various countries so as to assess the relationship between sonic bangs and their effects on people. Such test flights should be made at various heights so as to create a range of intensities and the aircraft should be flown—with different frequencies—both at night and day over various typical districts such as cities, densely or more sparsely populated countryside areas, and seas frequented by shipping. The tests should be supervised and evaluated, not least by medical experts. Although public reaction in the form of complaints and Gallup investigations should be assessed, the disturbance effect, in particular as regards sleep, should also be determined on a scientific medical basis.

The opinion has been expressed that if the *en route* sonic-boom noise is not any worse than the present "tolerable" airport noise, then it would—or must—be accepted by the public. I am convinced that if supersonic aviation were to be launched upon us on the basis of such a complete misjudgment of what is at stake it would cause severe public pressure, probably leading to extensive prohibition of this new form of civil aviation.

Turning now to the other problem—cosmic radiation. It is well known that the so-called total ionization has its maximum around 70,000ft, i.e., the very altitude at which the planned supersonic aircraft will fly. At this height the intensity is 200 or 300 times stronger than at the Earth's surface. It is also a fact that the so-

CIVIL SUPERSONICS: TOO MUCH HURRY? . . .

called primary radiation begins around 60,000ft (the altitude probably varying geographically) and reaches values which are not negligible at and above 70,000ft.

Some medical scientists seem to maintain that there is *probably* no danger at all. Others seem to be more dubious, stating (a) that one cannot neglect the possibility that the risk of developing cancer might increase for passengers who often fly at the heights in question and (b) that the danger might be greater to future children of the passengers, due to genetic effects.

The impression obtained is that an appreciable amount of uncertainty exists among the experts. The only point I wish to make in this connection is the following: We have to be absolutely certain, before we enter into the supersonic adventure, that harmful biological—in particular genetic—effects due to cosmic radiation at the "supersonic" altitudes are non-existent.

It would not be sufficient if an increasing number of medical experts were to state that they "believe" that the danger is probably negligible. It would be wrong to say that only if we get proof to show that there is a danger shall we refrain from building supersonic civil aircraft. What the potential supersonic passenger has the right to demand is that it must be proved beyond doubt that the danger is non-existent.

Thus the "burden of proof" with respect to the radiation hazard should fall on those who advocate supersonic aviation, and on no one else. If there remains an appreciable uncertainty with regard to the radiation danger, the supersonic passengers might just not appear to the extent needed for profitable operation. It must be emphasized that it will take a considerable time before the genetic effects can be satisfactorily assessed, even if rats and monkeys were used to simulate the human being.

Life and Man have developed during the course of millions of years on the so excellently designed spacecraft *Tellus* under the shield of its atmosphere, which protects the surface from cosmic radiation. Why, then, this extreme hurry to get above the major portion of this protection in less than a decade from now? Would we be much worse off if we waited a few more decades for supersonic aviation so as to have time to acquire knowledge rather than beliefs about the hazards of cosmic radiation?

I believe that progress in aviation should be defined as implying the greatest possible gain in time for as many passengers as possible, with the least possible disadvantage to people on the ground. This concept puts emphasis on a large volume of aviation with low-noise-level aircraft—as well as on short ground-travel time to airports—rather than on extreme speeds.

Limited Market

One of the main laws of transportation is that the volume of transportation, computed in passenger-miles, rapidly increases as the travel distances decrease. If one plots passenger- or ton-miles *versus* range for any one kind of total transportation—such as commercial scheduled inter-city traffic, or freight transportation, or ordinary travelling by private cars—one finds a curve which from a high maximum at a very short distance rapidly and continuously falls off with increasing range. Thus many more people and goods move around over short distances than over longer ones, even in respect of produced passenger- and ton-miles. Supersonic aviation, which must mainly be long-range, can, therefore, offer only a limited market.

With regard to scheduled passenger transportation, subsonic aviation in many countries (for instance, USA) has already practically absorbed the market on long distances and is the dominating means of transport in the medium-range bracket; and the same development is under way in other countries. The percentage encroachment of aviation upon the commercial short-haul market (say below 500 miles) is, however, rather meagre even in the USA; and if we consider the "short short-haul market" (say below 100 miles), it is practically non-existent. Thus the biggest transport market, short-haul traffic, remains to be conquered by aviation or, at least, to be appreciably encroached upon. This applies also to private travelling and to freight transportation.

As will be appreciated, great advances in short-haul aviation can only materialize by means of efficient V/STOL (vertical and short take-off and landing) aircraft. Construction of economical V/STOL types—which definitely is within the possibilities of the present state of the art—is, therefore, a much more urgent and profitable line of development than supersonic civil aviation will ever be.

There are, of course, a great number of other possibilities of development that are equally important, such as laminar boundary layer aircraft (implying low passenger fares); ground-effect machines; airport noise abatement; blind landing and take-off systems; building of large numbers of fairly small "V/STOL airports" within or close to city-boundaries in order to save ground-travel time; and last, but by no means least, safety, this including such increasingly important issues as traffic control and anti-collision devices required, above all, to make the intense future V/STOL traffic around cities sufficiently safe.

Safety Target

Safety in aviation is of tremendous importance. I believe that 40 to 50 years from now commercial and general aviation—including private flying—all over the world may have a volume in passenger miles some 50 to 100 times as big as the present volume of commercial passenger aviation for the world (excluding Russia and China). With the present fatality rate we would then have about 100,000 passengers killed each year, implying at least five air accidents every day, which would be quite intolerable.

In my opinion we have to set as a target that *the absolute number of accidents per year must not increase appreciably*. For compliance with this requirement we have to improve safety at the same rate as the growth of aviation and this would mean an improvement by a factor of 50 to 100 by the turn of the century. In view of the fact that no appreciable improvement in the fatality rate has been attained for many years in spite of all efforts, a raising of the safety level even by a factor of 5 to 10 is indeed a formidable task. Such improvements can certainly not be attained without some radically new approaches to the aviation safety problem, employing, *inter alia*, the most advanced electronic devices compatible with the state of the art at any one point of time.

If the Western World were to postpone the supersonic adventure two decades—or longer, if necessary, in order to assess and overcome the sonic boom and cosmic radiation hazards—and the vast sums of money thus saved were instead spent on all the other avenues of aeronautical research and development just indicated (with safety, V/STOL and low-fare subsonic jet transports at the top of the priority list), we could expect a tremendous and sound expansion of civil aviation, and one much greater than would be obtained by concentrating on the limited supersonic market.

Finally, what about the prestige aspect? It has been stated that the free world must fly supersonically before the Russians do it. I doubt it. If we have to think in terms of a race with Russia, let us engage in a race of common sense instead of a supersonic race; let us compete for the highest level of safety and for low-fare high-speed subsonic aviation, implying commercially sound and profitable mass air-transportation of people and freight. This would indeed be one of the most efficient means conceivable for increasing the standard of living of the Western countries and for welding them together culturally and economically.

FORTHCOMING EVENTS

Mar	16	RAeS Astronautics and Guided Flight Section: Symposium on "Training of Guided-missiles Engineers."
Mar	17	RAeS Man-powered Aircraft Group: "Power Transmission Systems," by S. S. Wilson.
Mar	17	Institute of Navigation: "The Long-term Plan for Air Traffic Control," by Capt. V. A. M. Hunt.
Mar	18	London Society of Air-Britain: a.g.m., Annual Recognition Contest and Film Show.
Mar	21	RAeS: "Some Aspects of Buffeting," by R. Fail.
Mar	22	Kronfeld Club: Film Show.
Mar	23	RAeS: Fourteenth Louis Blériot Memorial Lecture, "Problems of Short Take-off and Landing," by H. Ziegler.
Mar	24	Society of Environmental Engineers: Annual General Meeting.
Mar	29	RAeS Agricultural Aviation Group: "Atomization," by R. P. Fraser.
April	5	Kronfeld Club: "Air Touring Including the Sahara Rally," by John Dykes.
April	7	RAeS Rotorcraft Section: "Development of Stabilizing Equipment for Helicopters," by P. D. MacMahon.
April	10	RAeS Historical Group: Discussion Evening.
April	10-11	Loughborough College of Technology: Symposium on "Applications of Analogue Computers."
April	11	RAeS: "Direct Electrical Power Generation by Thermal and Chemical Means," by Prof M. W. Thring.
April	11	Guild of Air Pilots and Air Navigators: Annual Banquet.
April	12	RAeS Graduates' and Students' Section: "Man-powered Flight—Progress to Date," by H. B. Irving.
April	12	Kronfeld Club: "Pilcher, the Pioneer of British Aviation," by Lord Braye.
April	12	Society of Environmental Engineers: Discussion on "Climatic and High-vacuum Environmental Test Chambers."
April	19	RAeS Agricultural Aviation Group: "A Review of Current Developments in Agricultural Aviation," by Dr W. E. Ripper.
April	20	RAeS Astronautics and Guided Flight Section: Symposium on "Air Traffic Control."
April	25	RAeS: "On the Origin, Structure and Growth of Vortex Separations," by E. C. Maskell.
April	26	Royal Air Force Anniversary Concert, Royal Festival Hall, London.

RAeS Branch Fixtures (to Mar 23): Mar 22, *Preston*, "Some Requirements of the Modern High-speed Motor Car," by Frank Costin; *Weybridge*, "She's All Yours—Experiences with the Introduction of the Viscount and Vanguard," by Capt R. Rymer.

FLIGHT SYSTEM SURVEY

AIDS FOR THE HELICOPTER

AT the Rotorcraft Section meeting of the Royal Aeronautical Society in London on March 3, two important papers were presented on helicopter IFR operations, one by Bell Helicopter Co and the other by BEA.

The Bell paper, entitled *Recent Helicopter Instrument Flight Developments*, was prepared by H. W. Mitchell, assistant chief of the company's electronics department, and read by Mr B. Kelley, vice-president of engineering. A history of Bell research on tactical operation of helicopters under all visibility conditions—a programme occupying several years, with 480 hours' flying—was followed by a description of the Interim Integrated Airborne Instrument Landing System (IIAILS), which is now being evaluated by the US Army in a Sikorsky H-34. The original specification called for operation of helicopters without stability augmentation in any visibility conditions and over almost any kind of country.

In the equipment evolved, beacon information, compass, vertical gyro, cyclic control, barometric and absolute height and airspeed inputs are used to compute flight-path and control signals for presentation on two c.r.t. displays. The only ground equipment is the battery-operated, microwave Remote Area Instrument Landing System beacon, interrogated by the airborne equipment on a frequency of 500Mc/s and replying in the X-band. The airborne RAILS aerial rotates continuously and, after receiving a reply from the beacon, completes a further rotation to check proper reception. Thereafter it locks on to the beacon and azimuth, elevation and range data are derived and passed to the analogue computer which forms the central element of the airborne system.

The computer incorporates redundant-circuitry techniques so that component faults will cause a loss of accuracy rather than complete failure. The eight basic inputs may be supplemented by Doppler, normal ILS, LF range and ADF. On a control panel the pilot can select modes for navigating with the aid of RAILS—over or up to 5,000ft to one side of a beacon; landing at or near the beacon; navigating by compass; or navigating along a Doppler track. Take-offs can be made using the beacon land setting. Doppler or compass, and height and speed inputs allow a cross-country flight to be closely programmed from take-off to landing. There are ten beacon frequencies and ten aircraft may simultaneously use each beacon—a capacity well beyond normal operational requirements. A speed setting governs cruising speeds and is automatically replaced on the approach by a programmed deceleration. Glide-slope angles of 6° or 12°, and cruising heights up to 15,000ft, can be programmed.

The analogue computer calculates the required flight parameters and feeds a display generator which controls the two cathode-ray tubes of the main flight director. They present an interesting (and at first puzzling) mixture of director and indicator functions and "inside-out" and "outside-in" displays. The symbols appear in red, which can be seen against direct sunlight. The main attitude element is a moving aircraft symbol. In the director mode the aircraft symbol is flown towards the circle in order to make good the flight-path; and a small black dot moves vertically to indicate rate of climb or descent and sideways to indicate heading error. The pilot flies towards the circle with the object of bringing the dot into its centre. In the lower part of the attitude display a horizontal line begins to rise when the helicopter is within 300ft of the ground, and "beads" along this line move to represent drift relative to the ground. The beads on the vertical line, a departure from the forward-looking display, move to represent forward speed over the ground. The pilot thus has an accurate representation of attitude, relationship to the flight-path, height and lateral and fore-and-aft movement with which to achieve the landing, generally at about 2kt forward speed. During the approach, airspeed values are automatically replaced by groundspeed and barometric height by radio height, while display sensitivity is changed.

The lower c.r.t. is both a horizontal situation and command display. Crossed lines respectively demand the lateral and fore-and-aft cyclic-stick position; and the two concentric circles, one of them fixed and the other expanding or contracting, indicate relationship to desired height. Round the situation display is a compass ring showing heading at the 12 o'clock position. The location of the beacon, when interrogated, is shown by the dot, and a radial line indicates the bearing of the beacon against the compass ring. Maximum beacon range is ten miles; and the range scale changes automatically to 0 to 6,000ft (and a caution light appears) as the range reduces. As a stand-by, the attitude symbol can be switched to the horizontal display.

Although this highly compounded display seems to violate all previous instrumentation tenets, Bell have found that it works effectively and they maintain that traditional display criteria no longer apply. The helicopter may be flown with either display alone and the approach is as easy as cross-country flying.

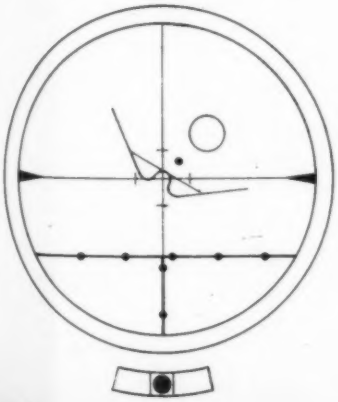
The situation and director display with crossed-lines for cyclic stick-position director, and the radial line for beacon bearing and range. The concentric circles form a height indicator

Entitled *Helicopter Approach Guidance*, the British paper was prepared by Mr S. G. Lennox of the project and development department of BEA. It presented the first detailed summary of the research carried by the BEA Helicopter Experimental Unit, in conjunction with MoA and the Blind Landing Experimental Unit, into the problems of instrument approaches for helicopters in airline operations. Mr Lennox dealt first with the particular helicopter flight characteristics which influence the profile and execution of a precision approach and, having stated the control and flight-path conditions, summarized the various methods and equipment which had been evaluated. He also indicated the likely configuration of a city-centre landing site and its approaches and effects of wind conditions. The table below shows the distances and cloud bases needed to correct various approach-path errors in visual flight after breaking cloud.

Decca Navigator, precision radar and microwave beam systems were reviewed and their use for instrument approaches examined by the lecturer, who concluded that no existing aid would meet the requirements. When the aid was available, cloud-break heights of 300ft and visibility of 300yd could initially be used, but better instrumentation might allow 200ft and 200yd. Lighting could increase the 200yd visibility by 50 or 100 per cent.

APPROACH-PATH ERROR CORRECTION

Errors at Break-off			Visual Range to correct (yd)			Related cloud-break height (ft)		
Lateral (ft)	Track angle (degrees)	Height (ft.)	Descent angle			Descent angle		
			10°	15°	20°	10°	15°	20°
50	5	25	320	220	170	190	195	200
100	10	50	390	270	200	250	260	260
150	15	50	450	310	240	290	290	300
200	20	75	500	350	260	335	350	340
300	25	100	570	400	300	400	410	410
500	30	125	650	430	330	465	460	465



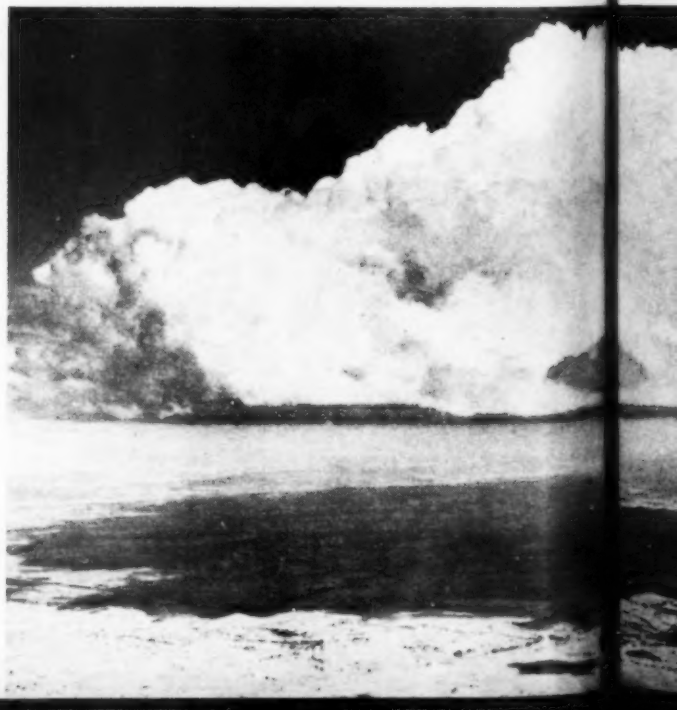
Attitude director display of the Bell helicopter flight system. Note the moving aircraft symbol, horizontal line for height and lateral drift, and vertical line for groundspeed. There are both ring and dot director symbols

The Rainmakers

Solution of silver iodide in acetate is pumped into one of the burner tanks of the Cessna before take-off

Left, a large cumulus cloud before seeding with silver iodide, and (right) the same ...ling, 30 mi

Pilot examines port-wing burner as the aircraft is being fuelled



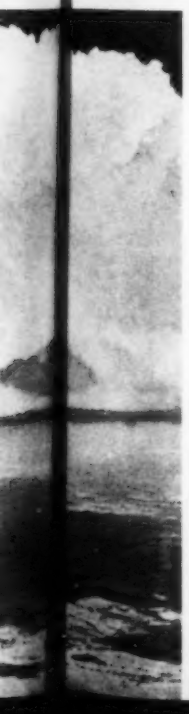
The two under-wing burners are visible in this dramatic picture of a Cessna 310B of the Commonwealth Scientific and Industrial Research Organization used for the Australian experiments

In the United States and in Australia, artificial rainmaking with the help of aircraft has been practised with varying degrees of success for many years. Ground-based experiments in the United Kingdom were carried out by the Ministry of Supply's Chemical Defence Experimental Establishment at Porton, near Salisbury, beginning in 1955, but failed to produce conclusive results. These photographs show a recent successful operation carried out by the Commonwealth Scientific and Industrial Research Organization near Wagga Wagga, New South Wales.

Pioneer work in this field in Australia began in 1947, when the Organization produced what is claimed to be the first-ever man-made rainstorm by dropping dry ice from an aircraft into a cloud. Perhaps the most effective artificial freezing nuclei yet discovered are crystals of silver iodide, produced by burning a solution of silver iodide in a hot flame. The Australian experiment depicted here, in which such nuclei are injected into clouds from a Cessna 310B aircraft, involves the use of special burners mounted beneath the wings of the aircraft near the tips. Each of the ground burners used in the Porton experiments generated about one ounce or 50,000,000,000,000,000 silver iodide crystals per hour.

The objective is to inject the crystals into regions where the temperature is −6°C or colder, but it is usually satisfactory to release the smoke just below cloudbase, whereupon the nuclei are dispersed into the cloud by upcurrents. Results of five years of the Australian work, reported last year at the International Conference on Science in the Advancement of New States held at Rehovot, Israel, indicate that conclusively effective results were obtained. In the New England and Snowy Mountain regions of Australia, and selecting the clouds for seeding at random, the rainfall was increased artificially by 30 and 19 per cent respectively.

t) the same ling, 30 min later. Increases in rainfall of 30 per cent and 19 per cent have been achieved, using clouds selected at random, in two regions of Australia



THIS article, by an American correspondent, considers the relative positions of the Soviet Union and the United States in what has become known as the space race. The opinions he expresses are his own and not necessarily those of "Flight"; in particular, the reports quoted to the effect that the Soviet Union has attempted unsuccessfully to place a manned satellite in orbit are not accepted as factual by "Flight."

IT is generally well known that the United States Government (for accounting purposes) operates on a fiscal year which begins on July 1 and ends on June 30 of the following year. Accordingly, the late winter and early spring months of each year are spent planning for next year's expenditures. One of the challenging problems facing those responsible for America's budget in this and forthcoming years is a decision as to how much money should be spent on space exploration. Similar problems must annually occupy the thoughts of the Russian planners.

For the USA, which just over three years ago placed its first satellite in orbit, a major decision is required as to whether or not to continue the present rapid expansion of space-type activities. Not only is an increasing number of dollars being spent annually on this one particular scientific field, but an ever greater portion of America's scientific/engineering talent is being assigned to orbital and deep-space projects. With yearly "space" expenses, both NASA and military, already exceeding one billion dollars and rising at an appreciable rate, it would seem appropriate to pause occasionally and re-examine America's goals in space. The new Kennedy Administration has indicated that it will make such a study on a high priority basis.

The Space Race

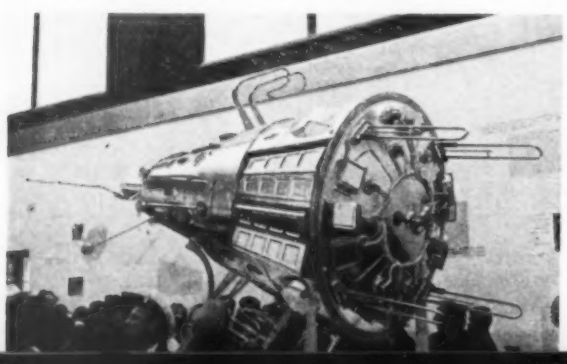
BY DON ADAMS (New York)

For the Soviet Union, which last month recorded another spectacular space "first"—the Venus launch—there is a question as to how to maintain its position in the spotlight on the world's stage. The drain on Russian scientific talent must be equally as significant as that in the USA and, with America's (i.e. NASA's) technical plans for the next ten years in space already an open secret, the Soviets must weigh heavily the sacrifices necessary to remain ahead. And for those countries not yet deeply involved in the intricacies of space work, there is the problem of where, when and how to enter the contest for world headlines and the acclaim that follows a successful firing. Each nation has its own unique problem.

The Soviet space programme appears to be almost exclusively centred on maximum exploitation, for propaganda purposes, of the payload capability of their big ICBM booster. They have at their disposal, of course, other equipments and techniques, but it is clearly the *booster* which has given them the lead they possess. Grossing over one-half million pounds at lift-off and powered by some 850,000 pounds of thrust, the Russian space booster is the product of many years' effort to design a very conservative and consequently relatively reliable big rocket engine. As is characteristic of their approach to technical problems, it would seem that the Russians have concentrated on developing a straightforward design. Hence we find the use of inefficient (by today's standards) but easily manageable rocket propellants.

One can imagine that the same design of rocket was fired many times until it worked to perfection. Few changes were probably permitted in the early design stage—a condition undreamed of in US circles—and the resulting successful booster design can be attributed to sheer perseverance. Realistically, one of the best means of achieving reliability is to resist to a fanatical degree the inherent tendency of the designer to make his design, even if it works, a little better. One can guess that this was the course pursued by the Russians. Numerous static firings must have been made after careful and lengthy countdowns, and only when faulty design practices were uncovered during static firings were design changes tolerated. Ultimately, a very workable, if somewhat inefficient, booster was evolved. The most careful kind of pre-launch countdown was then conducted prior to actual firings. This philosophy produced results, and Russia is today capable of hurling seven-ton, man-carrying size payloads into Earth orbit.

The Soviet Union: Sputnik 3 replica on show at Moscow exhibition



The United States: Dr Wernher von Braun testifies before the Senate Space Committee in Washington. Right, model of Saturn fourth stage

Russia also has an ICBM guidance system (probably radio-command). It is reportedly not as accurate as that of the American Atlas/Titan guidance system, but it is good enough to have guided the Soviet ICBM into orbit. Several other types of equipment must also exist in order to explain the Russian space successes. The Soviets unquestionably possess a gas-jet stabilization system, which accounts for their ability to orient a vehicle in space to some predetermined reference system. Infra-red horizon scanners are also suspected: these could be based on their IR air-to-air missile experience. Given these tools *and not much more*—and certainly nothing beyond today's state-of-the-art hardware in other fields—it is possible to account for all of Russia's firings.

The heavy Earth orbiters were the product of the big booster and ICBM guidance. The lunar shots can be similarly explained; the big booster was made to produce a "fast" lunar trajectory with a moderate payload. A guidance system that would not be tolerated in an ICBM could then produce a strike on the lunar surface. Guaranteeing a controlled near-miss on the Moon is more challenging, but again within the capabilities of current guidance systems. Photographing the Moon's rear face would be accomplished by re-orienting the space vehicle to some lunar reference—the horizon scanner could effect this—or simply by keeping the vehicle Earth-oriented while it passed the Moon. If things went well and sufficient pictures were taken, it would be likely that some photographs would contain pieces of the lunar terrain. Transmitting the pictures back to Earth is demanding, but, when one has a large payload, an extra supply of batteries (and their high power output) can be used to make up for electronics inefficiencies.

Use of Parking Orbit

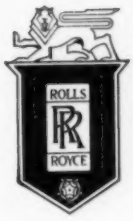
The recent Venus launch could have been accomplished with the same equipment. As has been known for some time, the use of a "parking orbit" for interplanetary launches has many advantages; the United States had not tried the scheme because she lacked a booster large enough to place a worthwhile payload in a parking orbit. The Soviet Venus probe required a smaller guidance accuracy than would be required, for example, to return a space vehicle to a preselected point on the Earth's surface.

Mr William H. Pickering, director of Caltech's Jet Propulsion Laboratory, said of the Venus probe: "This was not an engineering breakthrough, but it was a demonstration of a very nice, precise operation." Much the same comment can be applied to most of the other Russian firings. This is not meant in any derogatory sense.

From a purely technical standpoint, the most significant of the Soviet space successes was the return of a payload from orbit. If indeed the miss-distance reported by the Russians in their landing on the Earth's surface was correct, the experiment must rank as a first-rate scientific achievement.

There has been much speculation in the United States as to whether or not the Russians have already attempted, unsuccessfully, to orbit a manned space capsule. Rumours are prevalent, and Brig-Gen Don Flickinger, an important voice in American bio-astronautic activities who last year forecast that a manned Soviet orbital shot might take place as early as April 1960, is understood to have lent credence to reports that the Russians have evidenced several disastrous experiences with manned payloads. The latest alleged incident occurred in February of this year just prior to the Venus launch. Many reports suggest that this payload was manned. The Soviets have emphatically denied this. Prof L. Sedov of the Soviet Academy of Sciences has been quoted to the effect that the firing had two main goals—to place an object of that weight in orbit and, once there, to keep it in its planned orbit with exact precision.

From a technical standpoint neither of these justifications seems logical. One simply does not hurl dead weight into orbit to confirm the simplest of analytical calculations. Certainly if the Russians are to orbit a man shortly, they must be well beyond the point of knowing that the booster can orbit a heavy payload. There is a



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The Space Race . . .

further point that the Russian ships which were at that time dispatched to the Pacific would have been entirely superfluous unless an attempt was to have been made to recover the payload from orbit. Prof Sedov's two goals were most likely *part* of the intent of the mission, but it must be sincerely doubted that they were *the* goals. Other reports hint at two earlier manned flight attempts, these supposedly having taken place in 1960. As long as the Russians have the ability to orbit a man and remain so secretive, every heavy object that they launch will bring speculations that the payload was manned.

One of the anomalies of the Russian position—irrespective of whether or not they have tried to orbit a man (or men)—is that, although a reliable booster can get one into orbit, considerably different skills are required to accomplish something once one is there. Most impartial observers concede that the Soviets are behind America in the production of highly precise, miniaturized airborne electronics (the Russians are good at heavy electronics, however, such as ground-based radars). The problem is complicated by the ferocious vibrations that the big booster must impart to satellites during the boost phase. One might therefore imagine that Russia has difficulties in producing specialized satellite instrumentation and in deriving information from payloads.

This would appear to be the case. Significant data derived from Soviet satellites is almost non-existent. Furthermore, it would appear that, in terms of actual research, the Russians have done relatively little considering the resources available.

The Russians may, of course, simply be withholding the information, but this would seem pointless. The suspicion here is that they have not acquired much meaningful data; and this opinion will not be changed until some evidence of the existence of the data is made known. A point to bear in mind is that each of the Russian firings could have been made without much data having been accumulated from prior launches. Given a substantial payload capability—which the big booster provides—one could make each satellite sufficiently conservative (i.e. overdesigned) in all areas to take into account the worst of expected conditions.

Future Russian Plans

Some speculation on future Soviet efforts is interesting. Thus far the Soviets have concentrated on a small number of flights, each one carefully chosen for its propaganda impact. In the future we may expect to see further maximum exploitation of the ICBM engine, again for propaganda purposes. Additional manned Earth orbiters will probably be attempted this year. There is a particular urgency for the Russians to orbit a man as soon as possible. They once had a lead of over two years over the USA in this endeavour; now they have about one-half of that time. The world is conditioned to the fact that the Soviets will be first in space, and should they not be the first to orbit a man they will suffer a propaganda blow of considerable proportions.

Several more lunar shots will probably also be attempted. We might expect that they will make a controlled hard landing on the Moon in the near future. If the previous guesses at the state of Soviet electronic capabilities are correct, it may be just within the Russians' capability to make a soft landing on the Moon within eighteen months; I should find it astounding, however, if they had the ability to return a payload from the Moon to the Earth's surface within the next three years. A launch at Mars is a distinct possibility, particularly if there is a lag in the manned-satellite programme. A Mars programme would serve to divert public attention away from American manned sub-orbital flights, should they occur before a successful Russian manned satellite firing. We might also expect to see increased attention on the part of the Russians to the scientific aspects of space.

The Russians will enjoy a continuing and substantial booster advantage over the United States for several more years. They will therefore be able to perform a variety of missions completely beyond the physical capabilities of America. However, the Russians must be faced with a long-range problem of how to maintain their popular advantage over the USA. With the present American lead in airborne electronics the United States would far outstrip the Soviets if both had boosters of comparable size. To keep in the forefront, the Russians must do one of two things. Either they must build a still larger booster, at least of Nova size, or they must make a determined effort to close the "electronics gap."

If Russia's failing is overconcentration on a single theme—use of the big booster for propaganda-style missions—America's fault is diversification. In the USA there exist projects to cover just about every plausible space mission and, indeed, some that are totally implausible. In the hectic days following the historic announcement that the Soviet Union had orbited her first satellite, there was nationwide concern over the question of how America might quickly excel the Russians in what immediately became the prestige-dominated space race. Countless dollars were spent on a variety of hastily conceived programmes. A separate civilian space agency, the National Aeronautics and Space Administration, was established to supersede the old NACA organization. Its mission was to direct America's peaceful space efforts.

Its budget growing from a meagre $145.5m in 1959 (Fiscal Year) to $401m in 1960 and $770m in 1961, the NASA is expected to spend approximately $965m in Fiscal 1962. The Space Administration therefore already ranks in seventh place amongst America's biggest-spending agencies (behind veteran's benefits and farm subsidies, among others), and even the most conservative estimators of NASA's future needs foresee annual budgets in excess of $2,000m within a few years.

The enormity of these sums is even now causing concern among some leading American citizens. Dr Dubridge, president of the California Institute of Technology and a physicist of international repute, has been quoted as stating that the race to put a man in space was "a useless weight-lifting contest" that might squander the nation's resources at a time when world prestige could be best gained through "important and useful enterprises." But aside from the questionable benefits of a man-in-space project, there is the broader question of whether space exploration *per se* holds forth more promise for man than does other scientific work. Is space exploration, for example, potentially more beneficial to mankind than the study of the oceans that girdle the Earth?

Has America Caught Up?

Since America's initial drive was directed at catching up with Russia in the space field, it is interesting to examine two basic questions which are now being asked in the United States. Have we caught up? Will we forge ahead in the future? A fair estimate of the situation would be to credit the Russians with a present significant lead in big boosters, and a considerable advantage in the propaganda aspects of their work. As for America, most impartial observers—or, at least, those intimately associated with the aerospace field—concede that the USA has a measurable lead in airborne electronics and data-acquisition.

The argument as to which nation's position is the stronger is endless (as well as being pointless). The common man would more than likely argue that Russia is far out ahead, while members of the scientific community would take an opposite viewpoint. But, since the common public far outnumber the scientific community, it can be logically argued that Russia *is* leading the race.

This conclusion has disturbed a large segment of the American people. As noted earlier, the public has supported substantial expenditures for space, and it is frankly disappointed that America has not so far outstripped the Soviets in space accomplishments. The anomaly in America's position is that, although large sums of money have been allocated to *win* the space race, virtually all of the money has been spent on purely scientific missions.

Evidently many hold the attitude that, although it might be worthwhile to spend $1,000m a year to gain a propaganda advantage, it might not be worthwhile to spend the same sum on science. This feeling is inherent in the popular move to establish the Air Force as the predominant space agency. The Air Force is keenly aware of the propaganda aspects of space and has captured the public's imagination with a host of unscientific but newsworthy schemes. The public eats up such flamboyance as that displayed by the Air Force when its representatives talk of underground lunar bases, etc. It would appear that, if America really wanted to beat the Soviets in headlines, she need only turn over NASA's budget to the Air Force. Science would suffer, but the public might be mollified.

Booster Reliability

As for the future, America seems to be developing ever-more-complex payloads for stretched versions of the boosters which have proved troublesome thus far, and for the new large Saturn booster. One is tempted to conclude that unless the Agena, Centaur and Saturn vehicles turn out to be more reliable than their predecessors, the USA will still be running in second place several years from now. A worthwhile suggestion here would be to proceed with all haste to develop very large solid-fuelled engines for first-stage propulsion.

It must be obvious from the preceding discussion that the possession of a reliable booster is *the* key to success in space. If one can at all refrain from developing a new booster, this action should be followed; boosters are an endless source of frustration. I personally would go out and beg, borrow or steal a booster before developing a new one. A thought comes to mind here. Would it not be possible to use for space exploration one or more of the Thor boosters now stationed in England, or the Jupiter missiles to be installed elsewhere in Europe? RAF crews, for example, have already fired several Thors, and launching sites are already operational. It would seem that one or two of the IRBMs could be sacrificed for space work without any real reduction in deterrent strength. In any event, the Thors will one day soon become militarily obsolete, but they may still be adequate for space use. Perhaps some plans could be made for their eventual use. It might be the quickest way for Europe to get into space.

Straight and Level

SENSATIONAL plans for a "new type of supersonic jet wonder plane" were revealed in London last week. Known as the Scruggs Brand X, the new airliner embodies a brilliant British invention described by experts as the X wing—the result of five years' secret research work by a team of Scruggs Aircraft Company engineers led by shy, pipesmoking Dr Fred Dome.

Asked at a London news conference to explain the significance of the X wing, Dr Dome, blinking nervously in the glare of television arc lights, said: "What we think we have discovered is a solution to the classic linearized equation for a second-order inviscid induced velocity, popularly expressed as:

$$V = -\frac{1}{U}\frac{dU}{dz}\int_{-\infty}^{x} w_1 dx - \frac{p}{\rho U} \ldots"$$

There was a gasp of amazement from the assembled aviation journalists, who became so excited that firemen and mounted police had to be called in.

Technical note. Dr J. Nit, British air expert, comments:

"The X wing solves a number of problems that have baffled aircraft designers for years. The X is hinged like a pair of scissors, so that the Mach shock cone can be cut to pieces and the entire wave drag eliminated. For slow-speed cruising the X folds into a simple straight wing. For speeds above Mach 3 the X folds into a wingless fuselage. For vertical take-off and landing the X wing revolves like a helicopter rotor.

"Speed range is zero to Mach 3.9, and the Brand X can fly forwards, backwards, upwards, downwards, and—yes—even sideways. It is without doubt a technololological breakthrough."

● Here's a true story. Once upon a time there was an exhibition of American naval research rockets at the Science Museum, South Kensington, and a photographer from *Flight* went along to take some pictures. A US Navy officer was there, too, and so the photographer invited him, and an Interested-Looking Member Of the Public, to have their photograph taken together with one of the rockets.

The USNO agreed, but the ILMOP politely declined. "What's the matter?", grinned the officer. "Your wife not know you're here?"

Well, some pictures were taken, including the USNO but excluding the ILMOP. Later, as the USNO was looking around another section of the museum, the ILMOP approached him and mutual introductions were effected with the greatest cordiality.

And who was the ILMOP? Assistant air attaché at the Soviet Embassy.

"I said where did you leave the car keys?"

● Tenders have been invited, announces the Minister of Aviation, for the construction of a multi-storey car park at London Airport Central. Meanwhile Mr Thorneycroft puts up car parking charges, as a deterrent to long-parking motorists.

But why wasn't a multi-storey car park commissioned a year ago—or even three years ago? Has no one in the Ministry been keeping a check on the growing demand for parking space? Obviously not.

I could forgive a planner for going to sleep over, let's say, airport building maintenance work. But car parks mean REVENUE.

As Mr Milward of BEA said in New York: "We don't have commercial minds running our airports at home." In America, he says, cars produce 30 per cent of airport revenues. In this country, I calculate, the figure is 1½ per cent—and last year our airports lost at least £13m, a present of 30s from the taxpayer to each air traveller handled at a British airport.

Now the Minister has to deter a major source of airport revenue. Could mismanagement go further?

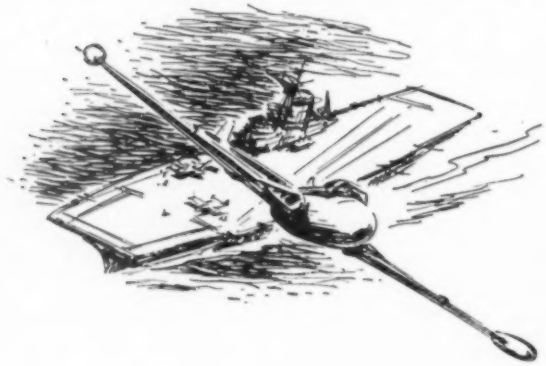
● "In 1926 Henry Ford, Sr., visited an aircraft show in Detroit. As he was leaving, he turned and looked over the planes and said, with his usual finality and quickness: 'Let me tell you, these things will never amount to anything until they use their power to land with!'" —*Mr Grover Loening in "Lessons From the History of Flight," recently published by the Smithsonian Institution.*

● "Considering that SFERMA use the airframe of the Beech Baron, it would seem only right to assign a higher rank to the Turbo-Travelair, which will now be known as the Marquis."

This question of precedence is always rather delicate. It is not just that a Marquis (or Marquess), ranks higher than a Viscount. I don't mind that. It's simply that there are not many ranks left for the aeroplanes that will succeed the Marquis. Right at the top of the list, of course, is the Queen—but Beech already have an aeroplane called the Queen-Air.

ROGER BACON

Even the best aviation artists sometimes use photographs as reference material—possibly even Geoffrey Draper, who did the sketch on the left. You might suppose that his reference was the photograph on the right, of a French-built Sea Venom taking off from the French carrier *Clemenceau*. But you would be wrong. His drawing appeared in a de Havilland advertisement in *Flight* for September 3, 1954. The photograph, published in *Flight* for March 3, 1961, was taken only a few weeks ago



Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Safer on the Roads?

IN Mr Alan E. Smith's article on page 178 of *Flight* for February 10, he quotes 0.34, 0.36, 0.35 for fatal (passenger) accidents per 100,000 hours (presumably passenger-hours) for 1956, 1957 and 1958. This is then 340 to 360 passengers killed per 100m passenger hours.

For passenger automobiles and taxicabs for 1956 and 1957 in America, 2.7 and 2.6 passengers were killed per 100m passenger-miles. Assuming 32 m.p.h. average speed, this becomes 85 killed per 100m passenger hours. It appears that one is four times safer on the roads!

Hessle, Yorks — A. H. CRAWSHAW

Soldiers at Farnborough

I HOPE I won't be accused of "nitpicking" in writing this, but I would like to point out that the reported participation of Army aircraft in this year's Farnborough Show (*Flight*, February 10, p. 179) will not in fact be a "first."

In the 1959 Show, Army helicopters, both Whirlwind and Sycamore, led the Transport Command fly-past. These aircraft were part of the Joint Experimental Helicopter Unit at Middle Wallop, and although serviced by RAF personnel and flown by Army and RAF pilots they did in fact belong to the Army, displaying the word "ARMY" in large letters well to the rear of the fuselage.

I had the pleasure of being a passenger in one of the Sycamores on one day of the Show, and although the fly-past was "short and sharp" it gave me a feeling of participation.

Waddington, nr Lincoln — S. M. ATKINSON, Ch/Tech, RAF

Recruiting RAF Aircrew

CONCERN over RAF aircrew recruitment has been openly expressed recently in statements by senior officers and Ministers at Service functions up and down the country, and I am always a little surprised to read their opinions (or opinion) as to the remedy. The fear of a future "push-button Air Force" is usually put forward as the chief cause of the problem, and this could be a fair analysis; but is it enough to push out such vague assurances as "we intend to have manned aircraft in service as far ahead as anyone can foresee," as if to wave the wand of truth at the situation?

The fact is that nobody can foresee very far nowadays when modes of warfare develop at such an awesome pace, and these statements give little comfort to the potential recruit who is required to pledge eight years of his freedom to the Service from the word "go." The difference between eight and four years (the former short-service commission) might make all the difference in the world to recruiting figures, and I should have thought it a bit more realistic to employ aircrew on more of a short-term basis. This presents the question of whether it is worth training a pilot for about two years' operational flying; but can anyone confidently say that the same pilot will not be redundant after that period?

But this is the gloomy side; if the pilot is of the right type and vacancies still exist, he will more than likely volunteer for further service. Apart from the "eight-year" stigma, I would be interested to know if the complete exclusion of the NCO pilot and/or navigator is really essential, even nowadays; also whether the modern "advanced" selection procedures for aircrew are not just a bit too advanced for ordinary mortals. On leadership, the RAF regard it as inherent, like blue eyes; surely this must account for part of the apparent lack of "men of the right calibre," which is now giving them cause for concern.

Leeds 17, Yorks — CIVVY PILOT

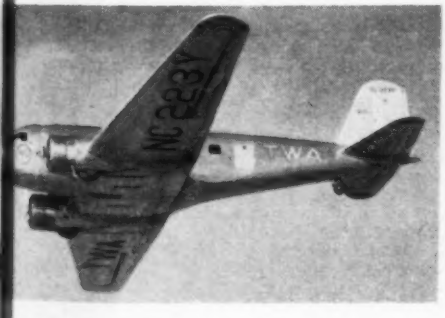
DC-3's Quarter Century

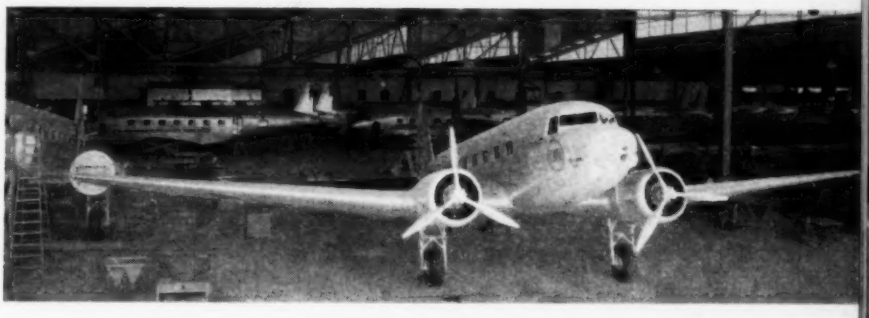
I WAS delighted to find in your December 23, 1960, issue Peter W. Brooks' article "The DC-3 is Twenty-five." Certainly no air-transport historian is better qualified to write on this particular aeroplane and its two distinguished predecessors, the prototype-only DC-1 and the then-fabulous DC-2 series. Both *Flight* and Mr Brooks are to be congratulated on the excellence of this historical article—likewise your artist Arthur Bowbeer, who has in my opinion given us the finest-ever sectional drawing of a typical present-day DC-3.

I am sure Mr Brooks will not object if I take the liberty of adding a few odd "postscripts" to his own report and, at the same time, I hope it will be possible for you to publish some of my own much-treasured old photographs from my collection of Douglas DC prints.

The very first DC-2, TWA's NC13301, I myself saw on at least two occasions whilst stationed at Basra Airport back in 1942. Although it was then painted in drab RAF war-time camouflage one could read its original TWA registration on the wings. Only about six bucket-type seats were fitted aft in the formerly luxurious peace-time interior; the rest of the cabin contained cargo-lashing hooks, etc. Despite its age and 15,000-odd hours in TWA's service, *Ally Sloper* (a name rather crudely painted on its nose) still possessed a lively take-off performance, even in the frightful humidity and temperatures of the Persian Gulf areas. Early in 1941,

Photographs from Mr Dennis Powell's collection (see "DC-3's Quarter Century," above). The first, taken on March 6, 1934, shows the DC-1 prototype; NC223Y on the wings indicates that it had received final Bureau of Commerce clearance. Next is seen the roll-out of the first DC-2 built, NC13301; this picture, say Douglas, "is the only print in our photo-library of the first DC-2 built and delivered to TWA" (who themselves have no picture of it)





Below, left, is the first DC-3 (DST series), photographed on December 18, 1935, during ground runs at Cover Field, Calif. Below, right, is the first DC-3A, delivered to United in August 1936. By September 1953, when it was advertised for sale by R. K. Dundas Ltd of London, it had logged 46,236 hr

CORRESPONDENCE . . .

Ally Sloper (with three other RAF-acquired DC-2s, plus Vickers Valentias and one requisitioned AW Atalanta) were used by No 31 Sqn for carrying troops to help quell the abortive Nazi-inspired Rashid Ali revolt in Iraq. This is yet another chapter in the long and varied career of the very first of the DC-2 line, which went into service on May 18, 1934, as recorded by Mr Brooks.

Despite considerable research to discover the ultimate fate of the first DC-3 built, NX14988 (actually a DST model, as were the following six DC-3s delivered to American Airlines Inc), I have only been able to record that it was impressed by the USAAF in January 1942 and given the Air Force designation C-49E. The second production DC-3 (NC16001) was given the same military designation, serving in the USAAF as 42-56097. I have reason to suspect the actual war-time records of both these earliest DC-3s are in the archives of Wright-Patterson AFB in Ohio, but I am quite sure neither of them survived to return to American Airlines in peace-time service again.

A total of 194 airline DC-3s were requisitioned by the USAAF in the year 1942, under the designations C-48/49/50/51/52 prior to the first production C-47 series, which were delivered in this same year. The first Lend-Lease deliveries of standard C-47s to the RAF began in June 1942 when No 31 Sqn received its first Dakota 1s in Burma, with No 117 Sqn in Egypt following a few weeks later.

Nairobi, Kenya — DENNIS M. POWELL

The Changing Face of Piarco

IN your issue of December 9, 1960, in the article "The Expanding Girdle" by Mr G. L. Marchault, it was very interesting to read the appreciation of the development of runways. I note that under the heading "International Airports—Facts and Figures," our international airfield Trinidad/Piarco is listed. The airport is known to us as the Piarco International Airport, and you may wish to know that the information which you have supplied is generally correct and you are to be congratulated on obtaining it.

A recent photograph of Piarco Airport, Trinidad, taken from the north of the main 10/28 runway while flying east. In the left background is the new terminal, 80 per cent complete; the old wooden building is in the centre of the picture. The hill on the horizon, 1,000ft high, is some ten miles distant

You may like to know also that the work of strengthening, re-surfacing and cambering the entire runway has been in progress for some time and is a continuing project contained in a development programme of this Territory. A recent evaluation of the aerodrome indicated that its subsoil and also its paved bearing surfaces meet requirements well above those officially stated. Some difficulties are experienced at times on account of the high temperatures. Surface cracks develop, especially along runway (white) markings on the asphalted runway where there is a differential in temperature. These surface cracks generally occur during the dry season, but any rain seeps through and forms small puddles in the clay soil. The blazing sun (since the rainy season does not mean persistent rains) then turns the puddles into "bubbles," and it is necessary to treat these individually. This recambering, resurfacing and general airport improvement will be continued for perhaps another three years as required.

In respect of the extension of the runway, work is already in progress and is expected to be completed this month (March). In addition to the actual runway, taxi tracks, loading apron and a new terminal building are expected to be brought into use towards the end of this year. Enclosed are photographs of the airport [one of which is reproduced herewith—Ed].

Trinidad, WI — CARL AGOSTINI, Director of Civil Aviation, Port of Spain

TAA Economics

I READ with interest the comment published in the issue of February 3, 1961, relating to the annual report of Trans-Australia Airlines for the year ended June 30, 1960.

The remarks in one regard suggest to me that there are factors which are well known to us in Australia but which are apparently not fully appreciated in the United Kingdom.

You say "it is seen that the airline fails to pass the acid test of managing to turn over its capital once in a year." By comparison it is admitted there are other airlines in the world who do this and more. We strive to better these standards. However, in making comparisons the analogy is only true if: (a) the cost of the fixed assets per unit of output are the same, and (b) the revenue rate per unit of output is in the same area.

In Australia, long distances from production centres make the investment in aircraft and spares more costly per unit than it is for those more fortunately placed; delivery charges must be added and base stocks of spare engines and parts must be higher to allow for procurement lag and safety margins. This, I estimate, adds about 10 per cent to the total investment in these items.

Our revenues per unit of passenger or cargo carried are lower than those which comparative airlines achieve, as the following will show:—

Sector	Distance (miles)	Fare rate per passenger-mile (pence sterling)	
		First Class	*Tourist*
Melbourne - Sydney	452	5.0	3.87
London - Glasgow	342	6.25	5.26
Paris - Rome	697	9.76	7.08
New York - Chicago	724	5.93	4.53
Los Angeles - San Francisco	340	6.44	4.14
Inc. above Australian sales		38-90 per cent	5½-90 per cent

These disabilities, if such they be, we try to mitigate by operating at a relatively high average load-factor, a high aircraft-utilization rate, and close attention to economy in all business sectors. We sometimes compare rather enviously the less strenuous conditions overseas with the highly competitive conditions existing in Australia, but we would not willingly change our lot.

Melbourne — R. EDELSTEN POPE, Director of Finance, Trans-Australia Airlines

Hands off Phineas

RE-READING an old copy of *Flight* (July 22, 1960) I note that Roger Bacon has shot down another cherished illusion. A whole generation of boys has grown to manhood convinced that the Spandau guns were as much a part of the First World War as Baron von Richthofen and Billy Bishop.

Who can forget the stirring stories in *Triumph*, *Wizard*, *Rover* and *Champion* that included whole paragraphs of *rat-tat-tat-tats* attributed to these deadly guns?

I must insist, sir, that some things remain inviolate. Next thing, Roger will be telling us Phineas Pinkham never existed.

Quebec, Canada — JACK BAILIE

Australia's First Airliner

IN "Sport and Business" (November 25) you published an article on the de Havilland Australia DHA-3 Drover in which it is stated that the Drover was Australia's first and only airliner. This is not so! The first airliner was the Larkin Aircraft Supply Company's Lascoter.

Designed by W. S. Shackleton, the Lascoter was also the first Australian-designed aircraft to receive its C of A. Only one was built and this entered service with Australian Aerial Services in March 1930 on the Melbourne-Hay route. The Lascoter carried four passengers or some 800lb of cargo at about 100 m.p.h. Initially it was powered by a 230 h.p. Puma, but this engine was later replaced by a 300 h.p. Nimbus before the aircraft entered service.

The seven-passenger Drover was actually Australia's second airliner, and the only Australian-built multi-engined airliner.

Inverell, NSW — LINCOLN A. WARD

Cody and "Colonel"

REFERRING to Col Bill Cody, mentioned in your issue of February 10, about 58 years ago I occasionally assisted him with his box-kites at the polo grounds (later the Crystal Palace Football Ground in the grounds of the Crystal Palace, Sydenham). Very often, he was running two kites on the same cable.

I would help him, on the average, five or six hours weekly and I would only get a few coppers. When one of the kites broke loose I helped to get it from the trees. Also, I often held on to the cable whilst the kite was on the ground, but as a rule the kite would be in the air all day long at about 400ft. It was around 10 to 12ft long and 5ft square.

Biggin Hill, Kent — H. S. PERCIVAL

A Gannet of HMAS "Melbourne" in close-up (left) and giving a demonstration of rocket-firing at a target towed by HMAS "Queenborough": pictures taken by "Flight" reader Michael Hill of Melbourne, during an "at home" held recently aboard the Australian aircraft carrier

SERVICE AVIATION

Air Force, Naval and Army Flying News

Director of Intelligence

A NEW appointment as a Director of Intelligence at Air Ministry has been announced for Air Cdre C. D. Tomalin, OBE, DFC, AFC. Last year he took the Imperial Defence College course, having previously commanded RAF Bruggen in Germany.

During the war he won the DFC with No 605 (County of Warwick) Sqn, of which he was CO. Later he became Intruder Controller at Fighter Command headquarters, and commanded High Ercall before going out to join Air Command South-East Asia. After the war he was Chief Instructor at the CFS (1950-51) and commanded RAF Celle in Germany (1956-57).

Singapore Showmen

VALIANTS of No 534 (PR) Sqn are to open the Singapore air display being held at Paya Lebar Airport from April 8 to 16. On detachment at RAAF Butterworth, Malaya, they are returning to the United Kingdom after their opening demonstration. Jet aircraft from other RAF units, and from the RAAF and RNZAF, are also participating at Singapore. They include Canberras, Sabres and Meteor NF.14s. Pioneers and Beverleys of the Far East Air Force are to show typical close-support activities. Two displays of formation aerobatics will be given, by three Sabres from No 78 Fighter Wing of the RAAF and by Meteor NF.14s of No 60 Sqn based at RAF Tengah on Singapore Island.

Bismuth Operations

A SQUADRON which regularly seeks out bad weather is No 202, commanded by Sqn Ldr M. P. Davies and based at Aldergrove in Northern Ireland. Described by Air Ministry as "the only long-range meteorological unit regularly engaged on this type of work" it is equipped with specially modified Hastings aircraft and has been operating in this role for 14 years.

The aircraft carry a crew of eight (including two air meteorological observers) and the task includes weather sorties known as "Bismuth" flights which extend some 800 miles into the Atlantic and range from the southern reaches of the Bay of Biscay through the Western Approaches to Icelandic waters. These flights play a very important part in the forecasts issued by the Meteorological Office. The squadron is notified by the Central Forecasting Office at Dunstable of the track required to be flown, normally arranged so the aircraft fly into areas where information is limited or bad weather suspected. Most of the flights are made at a height of 1,500ft but parts of the track are flown at 10,000 or 18,000ft.

Successor and succeeded: Air Chief Marshal the Earl of Bandon, new Commander, AAFCE (left), with his predecessor, Air Chief Marshal Sir Harry Broadhurst, who has retired from the RAF to become Avro managing director

Instruments carried in the Hastings include a psychrometer (a wet-and-dry bulb thermometer to give humidity readings), "frost point" hygrometer (measuring humidity below freezing point) and aneroid barometer. Some years ago one of the squadron's aircraft flew through the centre of the intense depression previously known as Hurricane "Carrie" which had caused the loss of the sailing ship *Pamir*, gaining information of great value. No 202 is one of the oldest squadrons in the RAF, having begun life in 1914 as No 2 Sqn, RNAS.

During "Operation Maize Bag" over the Northern Province of Kenya: RASC members WO2 T. B. Underwood (left), Lt T. D. Yeats and Maj J. O'Brien, CO, No 16 Air Despatch Coy. The operation was to supply drought-affected areas

IN BRIEF

Air Chief Marshal the Earl of Bandon, Commander AAFCE, is to be principal guest at the Glasgow UAS annual dinner on Friday, April 7.

President Nkrumah of Ghana visited the RAF College, Cranwell, on March 11 and also No 6 FTS, Ternhill, where ten Ghanaian Air Force cadets are receiving flying training as pilots. On the same day it was announced that Air Cdre John Whitworth had been appointed Chief of Staff of the Ghana Air Force.

Fou Ts'ong, the Chinese pianist, will be the soloist at the sixth annual RAF anniversary concert at the Royal Festival Hall on April 6.

No 15 Sqn is compiling a pictorial history and would be interested to hear from ex-members or others who have relevant material. Anyone who can give or lend photographs should get in touch with Flt Lt J. Shaw, No 15 Sqn, RAF Cottesmore, Oakham, Rutland.

No 60 Sqn officers' dinner club is holding its 8th annual reunion at the RAF Club, Piccadilly, London W1, on Friday, April 28, at 7.0 for 7.30 p.m. Dress, lounge suit. Tickets (13s 6d) may be obtained from Air Cdre W. Wynter-Morgan, "Wentworth," Mount Herman Road, Woking, Surrey (Woking 995).

SPORT AND BUSINESS

Private View BY P.P.O.

IF you fly for fun, and want to enjoy it, do not be frightened of radio. It can be fun to use, and it is not all that difficult. Once you have learned the phonetic alphabet and the common-sense patter that accompanies it, all you have to remember is not to talk too much: other people may be wanting to use your frequencies also.

Modern headsets are light and easy to wear, and look quite attractive on ladies. Before long, no doubt, we shall have them made in coloured plastics and designed to keep your hair tidy.

The only trouble in this country just at present is the number of frequencies you have to have in your radio set. On looking through the excellent *Aerad Flight Guide*, I notice that most Continental aerodromes have a single frequency, which is 119.7, for both Tower and Approach. If we had that over here too, it should surely be possible to devise a radio set with just two standard frequencies—119.7 for ordinary cruising and 121.5 for emergency. These two, with space for just two more crystals to be fitted as required for any special frequencies, would surely enable the private pilot to obtain comparatively cheap and light radio sets which should keep our ATC boys happy and also be real time-savers and trouble-savers when we want to land at strange airfields.

Of course, you have to have a radio licence—but this is not too difficult to obtain—and the idea does assume a sympathetic and friendly attitude from the folk at the ground end of the business.

I have only one fear, based on sad experience: that it will give our Ministry just one more stick to beat us with when we want to use our aeroplanes for pleasure and usefulness. On the other hand, with human controllers, it could be that they will be able to ring for a taxi so that one will be waiting when we land.

Another fear is that, once we start using radio, our bright sparks will see opportunities for further restriction on those of us who can't afford the cost, or the weight, or whose radios are u/s. The "keep 'em on the ground" brigade just must not be allowed to use what should be an intelligent and progressive aid to the private flier, and all air users, for destructive purposes.

Which reminds me of a good and true story of a young man who wanted an aeroplane. He had a fairly rich father who was not very air-minded, and the cost of a modern aeroplane seemed to stick in the old man's throat. So, nothing daunted, the young man bought himself a sporting but ancient craft—which the owner was only too pleased to see the back of—for a nominal sum, and invited his fond papa to take a trip in it with him. Papa, of course, refused, as had been anticipated.

The next move was to persuade him to pick up his son by car at a selected airfield where the young man was due at three o'clock on a winter afternoon. The young man turned up just when it was getting dark at about five o'clock, to find that worried parent had been spending the last two hours with the professional pessimists who are so common at our airfields. Having worked himself into a sad state of anxiety, he was so happy to see young hopeful arrive that he positively insisted on buying him a new and better aeroplane.

"Spending two hours with the professional pessimists . . ."

The moral of the story is that even the pessimists and their ilk may be made useful if you are sufficiently determined, use your loaf, and have the right sort of papa.

We must use this technique with radio. When you have one, and a licence, jolly well use it. We don't want to interfere with the airliners and the professionals; we only want to share the air with them. So I am sure that, when there are a few more private aeroplanes all gassing away into the ether, a kind papa will allocate to us a frequency all of our own and give us a nice little radio set which we can use when it is really useful, as a means of finding our way and keeping out of other people's—but not to increase restrictions and difficulties.

FLOCKHART'S RECORD ATTEMPT

TO THE OUTLINES of racing driver Ron Flockhart's Sydney–London record attempt given last week can now be added some of the detail which makes this one of the most exciting solo flights of recent years.

Flying a high-performance piston-engined fighter on a route now almost exclusively reserved (by possession if not by definition) to transport aircraft was, Flockhart said, "like driving a Cooper on a bus route." Some of his impressions, as told to *Flight* on his return, are recorded below.

★ ★ ★

Mustangs in Australia are not expensive, and spares are in plentiful supply; the situation has been described as being akin to "the availability of Tiger Moth spares in the UK about six years ago." United Dominions Trust purchased the aircraft for the record attempt for around £2,000 and Flockhart was able to find additional 75-gal combat tanks for about £7 each. Rolls-Royce did sterling work checking the Merlin 38, which had run only 110hr since new, and had never been "through the gate." Smiths Australia took on the overhaul of a rather varied selection of instruments, while the magnetos were overhauled in Scotland.

Preparatory work on the airframe (the aircraft is a low-level attack version built for the RAAF Reserve by Commonwealth Aircraft) was undertaken by Illawara Flying School. In particular, Illawara modified the fuel system by introducing a manual device by which the system could be de-pressurized. Two static vents for this purpose are located just under the cockpit sill, and there is a valve inside. This modification enabled Flockhart to run the combat tanks dry without the risk of sucking air; the system then had to be repressurized (from the exhaust side of the vacuum pump) to assist initial transfer. In practice it worked very well, although the change in torque as a tank emptied had to be very quickly corrected with aileron to prevent the Mustang rolling.

All fuelling arrangements along the route were made by Esso, who, Flockhart says, were unfailingly efficient and helpful. Normalair supplied additional oxygen equipment, Dunlop went to much trouble to find new tyres and Lodge supplied new plugs. The last-named gave no trouble at all; at Rolls-Royce's suggestion the Merlin was opened to full power every half-hour and again, very briefly, during the descent and approach.

Flying a Mustang for the first time was like "driving an ERA after a sports car"—things seemed to happen very quickly, and the long nose meant learning the fighter technique of a curving approach. Flockhart says that he had one or two bumpy landings, but that he quickly came to like the aeroplane very much indeed; it seemed big and very powerful but, in spite of its responsiveness, was amply stable for the long hours of steady, level cruise. One difficulty was that air traffic controllers did not appreciate the impossibility of doing a long, straight-in approach in a Mustang; Flockhart made a practise of asking for a visual circuit at each airfield he visited.

He was surprised to find that, over Australia, if a pilot requests a QDM he then has to file an incident report; this made his navigation more difficult, particularly as, on the way north from Alice Springs, a magnetically charged dust storm affected his ADF. From 12,000ft he followed the faint line of a solitary railway across otherwise trackless brown country.

The dread reputation of the Timor Sea has these days largely been forgotten, but the pilot recalled it when, well out over the water, he first saw the dark ominous line of an inter-tropical front piling-up (so he heard from reports on the radio) to above 50,000ft. From 12,000ft he dived down to the surface, sought and found a

The unsuccessful attempt by Ron Flockhart to complete a record flight in an ex-RAAF Mustang fighter from Australia to the United Kingdom is detailed on these pages. Right, Flockhart at Sydney; far right, his Mustang

hole, and plunged into the milky mist. It lasted for about ten minutes before the front cleared to broken weather on the other side; by this time most of the paint had stripped from the leading edges. These diversions had used a good deal of fuel, and the Mustang diverted to Bacau for replenishment. It came after only a short delay—in 45-gal churns from under a thatched hut—while Flockhart spoke broken Spanish to a Portuguese ATCO at the other end of a telephone wire.

From Bacau the route led over "the loveliest part of the trip"—over the Balinese Islands and coral atolls, east and north-east to Singapore. Here the Mustang was delayed because of an accident on Rangoon's runway and, when Flockhart left, it was his first experience of flying the aircraft by night. He found it pleasant; the ADF behaved in more constant fashion and he followed airways most of the way to Rangoon. On the apron was a CSA Tu-104, the crew of which evinced more than a passing interest in the fighter. For their benefit he held the Mustang down on take-off until he could pull up 4,000ft almost vertically into cloud.

Air-traffic and handling problems, which plagued the record attempt from start to finish, raised their head again at Calcutta. Forced off contact flying into a cloud layer at 2,000ft, Flockhart missed the let-down beacon and overshot to Barackpore, causing some excitement in the tower. Refuelling rapidly, he then set off on the longest leg of the flight—across India and Pakistan to Karachi. Using 43gal/hr, he had an endurance of about seven hours, and he completed the long crossing in 5hr 50min. He ate very little except some Horlicks tablets, but refreshed himself on landing with cold ginger beer which he had stored in the ammunition bay in Australia.

After this long leg he turned-around in about an hour and set off, by moonlight, to follow the Iranian coast to Bahrein. "Navigation at night," he said, "was wonderful. There is a great tranquillity about it. The isolation and the beauty contrasts sharply with the actions of those on the ground, who try to tie you down with streamers of paper. Flying at night in the moonlight, the only shadows are on the surface."

Most of the rest of the story has been told. Flockhart landed by night at Bahrein, where he found that the air had leaked from the port oleos. It was quickly repaired by the RAF, International Aeradio handled him "magnificently," and he was soon off, following the pipeline to the Lebanese mountains and Beirut. He cleared with Damascus, but then was surprised to hear them recall him while he was on the descent. Short of fuel, he had no option but to continue, and sort out a diplomatic muddle later. At Beirut (see story last week) the first trouble occurred; at Athens the overheating properly did its work, and the record attempt was ended. It was not the flying, nor navigation, nor preparation which was responsible for failure. It was, Flockhart said, an air traffic system out of touch with the individual needs of a type of flying that has not, by any means, yet disappeared from the global scene. A.T.P.

ZONE OF CONTENTION

JUST ISSUED by the Ministry of Aviation is a map of an area that private pilots have previously had to puzzle out for themselves—the Manchester Control Zone and terminal areas. The zone spans 45 miles from east to west and, in its revised form, has been permanently IFR since March 1. Shaded areas show the free lanes and free airspace north of Barton, although pilots should note that ATC clearance by radio is required into Woodford and Speke and that the approach route to Barton from the south is closed when visibility is less than five miles. Puzzle: find your way, in a VHF-equipped private aeroplane in visibility varying between four-and-a-half and five-and-a-half miles, from Yeadon (to the north-east) into Liverpool Airport. In practice, Air Traffic Control is most helpful to the needs of private pilots. The golden rule is: when in doubt, use the telephone or communications radio.

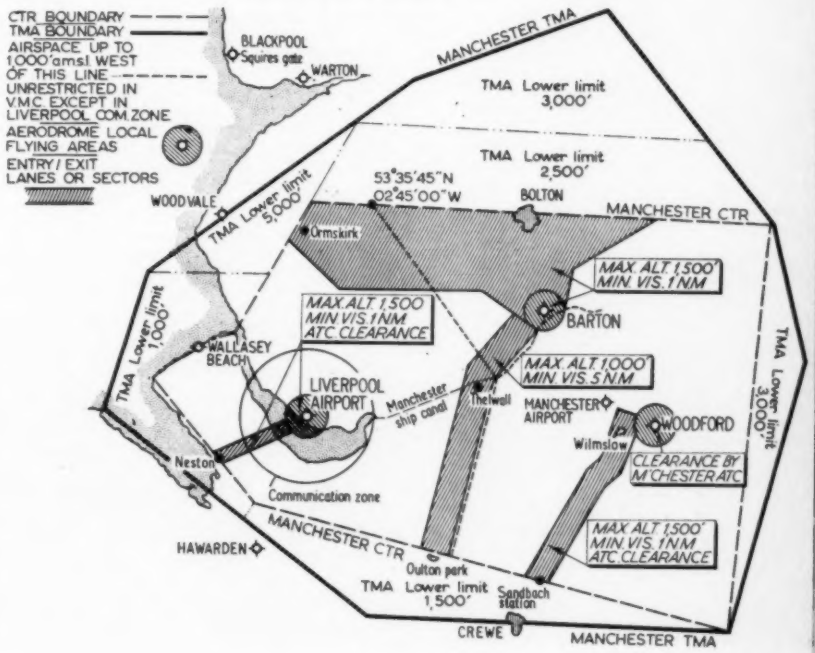
THE GLIDING YEAR

THIS COUNTRY'S 1,000th Silver C gliding badge was awarded at the British Gliding Association ball on Friday last, March 10, to Sgt E. F. Edwards, an engine fitter at the RAF Transport Command Station at Lyneham and a member of the RAFGSA Moonrakers Gliding Club at Upavon. The badge was presented to Sgt Edwards by Lady McEvoy, wife of the RAFGSA president, Air Chief Marshal Sir Theodore McEvoy. Also handed over on this occasion were the annual BGA awards (*Flight*, February 17).

A new trophy, donated by the Air League in memory of Robert Perfect, was presented by Air Cdre G. J. C. Paul. This is for the gliding club with the highest proportion of instructors.

In the BGA chairman's report, presented at the annual general meeting of the Association on March 11, Mr Philip Wills said that the development of the gliding movement during 1960 had been marked by "an increasingly fierce struggle for sites and against unduly restrictive air traffic control practices." The possession of sites, the chairman emphasized, would be of no use without reasonable freedom of airspace and, in this field, the BGA had been forced to fight hard for a policy which would combine safety with maximum freedom for all users of the air. "During 1960 all glider flying up the west coast has been permanently stopped, even in fine weather, by the imposition of an impermeable control zone of ridiculously large dimensions over the Manchester zone [see map below—Ed], from as far east as Buxton to the coast beyond Liverpool. This area has a traffic density less than one-fifth of that of London (one-twentieth of that of New York) and extends to cover Speke, which peaks on a few summer days to two-and-a-half aircraft an hour. Such an irrational attitude to collision risks would be laughable were it not so serious in its future implications for the well-being of our aviation and of our country."

Manchester control zone—re-drawn for reproduction from the MoA map (see "Zone of Contention," foot of column 1)



It was by Comet 4 that Dr Nkrumah of Ghana chose to fly to the Commonwealth Prime Ministers' conference in London. He travelled from New York, where he had been attending the UN. The Comet was chartered from BOAC. As we go to press it is announced by de Havilland that Dr Nkrumah has bought a Heron, for the personal transport of himself and his ministers; it will be delivered later this year

AIR COMMERCE

BEA v BOAC

"BOAC has strengthened its position in the Middle East by co-operation with the Middle East Airlines. Both airlines operate Comets. BEA likewise has strengthened its position in the Middle East (where there is a conflict of interest between BEA and BOAC) by co-operation with the Olympic Airways. Both airlines likewise operate Comets. Is it too much to hope, that, one day, we shall see BOAC and BEA co-operating with each other?"—Straight and Level, *Flight*, January 6, 1961.

SEVEN weeks after this was written the chairman of Middle East Airlines, Sheikh Najib Alamuddin, suggested (*Flight*, February 24) that competition between BEA and BOAC in the Middle East could affect relations between MEA and BOAC. The Sheikh suggested that a possible Middle East reaction to competition from BEA in association with Olympic and Cyprus Airways might be to drive Arab airlines into a protective pool. MEA would prefer to see a Pan Arab airline eventually brought into being with BOAC's assistance, but, said the Sheikh, "we cannot fight BEA without affecting relations with BOAC as well."

In association with MEA and their pool partner Air-India, BOAC operate 32 jet services a week through the Middle East. BEA operates 22 services through Athens and beyond, all of which are in association with Cyprus Airways or Olympic. Cyprus Airways services are all operated by BEA aircraft, and it is a source of resentment in the Lebanon that the other British corporation should advertise and should operate in competition with the local carrier.

In the House of Commons last week, Mr G. Chetwynd (Lab, Stockton-on-Tees) raised the question of "unnecessary and wasteful duplication of services between the two British airline corporations." He asked the Minister of Aviation, Mr Peter Thorneycroft, about the "grave danger" to BOAC's established position in the Middle East of a clash between BOAC and its associates, and BEA and its associates, in the Middle East area. Because of the "delicate political atmosphere" he suggested that it was necessary to have a co-ordinating policy between airlines operating in and out of the Middle East. He offered to send the Minister a memorandum on the matter and this Mr Thorneycroft accepted.

SAS CARAVELLE FLAP

A MODIFICATION programme involving the Caravelle's flap mechanism was initiated, it is learned, following a take-off incident some weeks ago to a SAS Caravelle at Madrid. The airline's report was as follows:

"During take-off from Madrid the pilot noticed that he had to apply right aileron and right rudder to keep the aircraft straight and level, as the aircraft had a tendency to roll and turn to the left. As he suspected a split flap deflection he selected various flap positions in order to minimize the roll tendency to the left. The aircraft was fully controllable and the captain decided for reasons of safety to land back at Madrid as soon as possible. No particular difficulties were experienced in the approach and landing phase.

"When inspected on the ground it was found that the left flap was 20° down, while the right flap was 35° down. Closer inspection revealed that the drive shaft for the right-hand flap was broken immediately outboard of the bevel gear in the wing root area."

FACING BACKWARDS IN THE HOUSE

"WE are in the Ministry told by our advisers that . . . the backward-facing seat probably does give an extra margin of safety in some circumstances." This was stated by Mr John Hay, then Joint Parliamentary Secretary, MTCA, in the House of Commons in May 1959.

Again the backward-facing seat issue has been raised in the House of Commons. Mr. A. Hopkins (C & Nat L, Bristol, North-East) asked the Minister of Aviation last week: "Will you require, before issuing the certificate of airworthiness, that all passenger seats in passenger aircraft should be backwards-facing?" Mr Hopkins also wanted to know whether the Minister was aware that 16 lives might have been saved if the Electra which crashed at Boston had been fitted with such seats.

Mr Thorneycroft's replies were to the effect that it would not be right to impose such a requirement on British operators; that he was keeping in touch with the American authorities; and that the whole question "is kept under review."

The last time this matter was raised in Parliament the Government's reasons for not making backward-facing seats mandatory boiled down to: (1) aircraft safety is increasing; and (2) airlines would lose money. The debate was reviewed in *Flight* for May 22, 1959, pages 726-727, and the questions then posed have never been answered.

Eighteen Caravelles have now been ordered by SAS for their consortium with Swissair, together with options on a further eight. Seen in this fine take-off study is one of four leased to Swissair, who are reported to be planning to operate an additional four

Half a dozen UK airlines are now operating the Viscount, including Tradair of Southend. Here is one of their two Viscount 707s, purchased last year from Aer Lingus. Together with the company's seven Vikings, Tradair Viscounts operate scheduled services, inclusive tours and charter flights from Southend

NO MORE BLOOD CHITS

SIX thousand pounds does not seem a high value to put on a human life lost in an air accident; but the point of the Warsaw Convention, enacted in the English law by the Carriage by Air Act, 1932, was that it established the *prima facie* liability of an airline to compensate a passenger killed or injured in an accident. As Mr Ronald Bell (Con, Buckinghamshire South) said in the Commons on February 24: "The passenger, while he loses by limitation on the amount which he can recover, does not have to argue about liability."

The old Warsaw Convention of 1929 set an airline's liability at £3,000. Mr Bell was introducing a new Carriage by Air Act which will double this to £6,000. The purpose of this Bill is to repeal the 1932 Act (which embodied the Warsaw Convention in English law) in accordance with the Hague Protocol of 1955. This protocol —which is now passing into English law—amended the Warsaw Convention in a number of important respects. For example:—

(1) It removed doubts as to whether the passenger could escape the £3,000 limitation by sueing the pilot or another employee of the airline; (2) It simplified ticketing requirements (previously a minor slip in writing out the ticket could deprive the carrier of protection under the Convention); (3) It defined more closely the meaning behind the words "wilful misconduct," which previously a passenger had to prove if he wanted greater damages.

The new legislation will apply also to aircraft operated by H.M. Government, thus rendering unnecessary the signing of the familiar so-called "blood chits."

A novel aspect of the Bill is that it introduces a French text into English law for the very first time. The Hague Protocol of 1955 is to be annexed to the English Act in the original French, which is the language to be interpreted in the event of any discrepancy with other texts. The Bill will now pass through the Committee stage before going to the Lords. It is hoped that other countries will follow the UK example. The Hague Protocol needs 30 signatures for ratification as international law; so far only 18 states have ratified it.

NEW-MARK FARES

REVALUATION of the Deutsche Mark has not, contrary to some reports, affected the price in terms of pounds or dollars of an airline ticket to or from Western Germany. German internal fares, on the other hand, are now about 5 per cent more expensive, in pound or dollar terms, than they were before the rate of exchange was adjusted on March 6. Outside Germany, only the value of the Mark has changed; fares have not.

This means that the number of Deutsche Marks to be paid for fares on international routes is now reduced. A German who previously paid DM195 (£16 10s) for a ticket at the IATA fare between Hamburg and London, now pays DM185, again equivalent to £16 10s. But if he buys a ticket at Hamburg to fly on the domestic route to Frankfurt he pays, as always before, DM102. Previously equivalent to £8 13s, the cost of this fare in sterling terms is now £9 2s. In other words, visitors to Germany will pay the same as before to get there, but will find internal air travel more expensive.

"WALK ON" TO CHITTAGONG

A "WALK-ON" service apparently closely akin to that now operated in the US by Allegheny Airlines and by Eastern is to be introduced on March 25 by Pakistan International Airlines. From details so far released about the scheme by PIA's managing director, Air Cdre Nur Khan, it is not clear if tickets will be sold on the aircraft or if they will be bought immediately before boarding. All that has been said is that the procedure will be "greatly simplified," and that the reduction in costs and overheads which it should bring about will be used to lower fares to levels comparable with those for second-class travel by rail.

In fact the fare reductions on these air-bus services, which will be operated initially in the East Wing of Pakistan, will be greater than the economics justify; it is intended that the service should be cross-subsidized by the more profitable routes which last year brought PIA a profit of £450,000. There are two reasons for this: firstly, PIA's social obligations to provide air transport are nowhere so pressing as they are in East Pakistan. Secondly, the airline is trying to attract, by really low fares, travellers who have not previously been able to contemplate air travel. These fares are thus a long-term inducement for travel on the other services. The air-bus services will operate between Dacca, Sylhet, Shamshernagar and Chittagong and between Dacca and Ishurdi. The existing Chittagong - Cox's Bazaar route will be converted to air-bus operation. The fare, previously Rs20 (£1 10s) will now be only Rs12 (18s).

VLF SHAMROCK

IN the spring of next year Aer Lingus are planning to introduce "very low fares" on their short-haul routes, and are looking for an aircraft with a greater capacity and lower seat-mile cost than the Viscount 800. The airline has already begun preliminary discussions with other operators and with an aircraft manufacturer, believed to be Vickers.

These plans were revealed in an address made recently by Mr Michael Dargan, assistant general manager (commercial) of the Irish airline, to a meeting of European tour operators in Dublin. "The airlines of the world need an aircraft that will seat, say, 100 or more people in reasonable, but not de luxe, comfort," he said. "They will be built with journey-lengths of some 300 to 500 miles in mind, so as to allow direct operating costs substantially better than those of any aircraft so far available," said Mr Dargan. He continued: "I am hopeful that we in Aer Lingus will shortly achieve a seat-mile cost which will allow us to make a substantial reduction in fares, possibly for the season beginning in the spring of 1962."

Nothing is yet known about the equipment that Aer Lingus envisage to implement these plans. Taking all factors into consideration, with emphasis on availability, operating economy, capacity, range and initial cost, it would seem that the Armstrong Whitworth AW.650 or 671, the Vanguard or the Britannia 100 (of which BOAC have a surplus) offer the most attraction to an airline flying routes like those of Aer Lingus.

Silver City are flying Renault Estavette vans from Le Touquet to Lydd. Both the import and export of cars by air is quickening as British motor industry production gets on its feet again

Delta's Convair 880s have now been in service for ten months; their first-service anniversary comes up on May 15. Here is a particularly pleasing study of the type

AIR COMMERCE . . .

STILL MORE VISCOUNT SALES

ANNOUNCED last week was the signing of contracts for another four Viscounts, bringing the total sold to 429. Although sales have slowed down since the four hundredth contract was signed in May 1958, 20 aircraft have been sold since January last year. The most recent purchasers are All Nippon, who are increasing their fleet by three, and Lufthansa, who, by ordering an additional 810 series aircraft, are bringing their total Viscount fleet up to ten.

Contract for the All Nippon aircraft was signed in Tokyo by Mitsui Bussan Kaysha, a merchant firm acting on their behalf. All Nippon are at present operating two V744s on lease while the three V839s they ordered last April are completed. Delivery will be from May 1962. The contract with Lufthansa is a repeat order for a Viscount 814; the last aircraft of their fleet order for nine was delivered in April 1959, and the new one will be delivered in December.

SLICES OF THE MADEIRA CAKE

IN applying to the Air Transport Licensing Board for a licence to operate from London to Madeira, BEA note that they have spent "much money and effort in co-operation with TAP, thus breaking down restrictions on United Kingdom-Portugal traffic."

Until TAP agreed to operate in pool with BEA in 1959, the Portuguese authorities had a restrictive approach to the opening up of Portugal by BEA. Actually, the arrangement is something more than a pool, being in fact a "consortium agreement" in which costs (of BEA-operated Viscounts) are shared as well as revenues. The proposed BEA service to Madeira, say BEA, would be operated via Lisbon and would be included in the pool, "thus enabling BEA to continue the process it has started."

The corporation notes that Madeira has not yet been fully developed, due to the lack of an airport; but Puerto Santo, on an adjacent island, now has a large airport, and plans for a small airport at Funchal are in hand. In their application BEA specify the use of Viscounts, Vanguards, Comets and Tridents, the last-named in 80-seat configuration.

Silver City also have applied to operate to Madeira, and this independent considers that the potential traffic "is such as to permit only one operator serving Madeira from the UK." Silver City emphasize their prior right to the route, in view of the fact that their flying boat associate Aquila, now defunct, served Madeira from 1953 to 1957. An interesting scuffle over how the Madeira cake is to be sliced up is now in prospect. This is a rare case in that it is to be a straight fight between a corporation and an independent for a new international landplane route.

NEW ROUTE FOR THE SPANISH POOL

SPAIN'S Costa del Sol is an example of one of the further-afield holiday playgrounds that are becoming more popular as access to them is improved. For a long while BEA has served Malaga, on the south-west Spanish coast, by a coach connection from Gibraltar, but they have recently applied to operate a direct service into a new airport that has now been opened to serve the resort coast. They believe that a separate service would be sufficiently popular to make it practical, even if some passengers were diverted from Gibraltar services.

In any case, and perhaps more to the point, it seems likely that Iberia may start soon a direct Malaga-London service which would drain traffic from the pooled route London-Madrid. The corporation are consequently proposing to operate direct to Malaga themselves, although in pool with Iberia, and they have applied for a licence to operate this route. This is a good example of pooling in operation; since BEA and Iberia are in pool on all parallel routes between the UK and Spain a new route proposed by either partner will result in an immediate application from the other. In this way the *status quo* is preserved.

BRITISH UNITED v CUNARD EAGLE

AS briefly noted last week, the Air Transport Licensing Board is hoping to open hearings on May 16 into the competing BUA and Cunard Eagle applications for a largely overlapping network of scheduled services from London to Europe.

Significantly, the Minister has not invoked that part of the Act which gives him the power to order the Board to reject these applications if he thinks (as he must in this case) that they look tricky as regards traffic rights. He has evidently decided to let the hearings take their course (it is to be hoped in public), knowing that any licence that might be granted by the Board provides no guarantee that the Ministry will authorize the necessary traffic rights.

Both independents obviously appreciate that the issue is not whether either one of them should be licensed to compete with BEA on any of the routes concerned. The question before the Board is whether *any* independent should be so licensed.

British United were the first to apply for a European network; but the question of "prior right" could lead to endless, and possibly fruitless, argument; both Eagle and BUA have licences either in operation or in abeyance for normal scheduled services between points in the United Kingdom and points in Europe.

This will be a case of not only BUA *versus* Eagle, but of both BUA and Eagle *versus* BEA, the corporation having already publicly announced its intention of objecting to all the applications.

The preliminary Eagle case supporting their applications is that "passenger and freight traffic on the routes concerned has increased annually by 15 or 20 per cent in the case of passengers and 25-30 per cent in the case of freight." They argue that traffic sources are extensive and that the rate of traffic increase—particularly in the case of freight—is "related to the service facility and price level." So far as price is concerned, say Eagle, "statistics prove that traffic volume has increased to a far higher extent than would have been

FAA's Aeronautical Training Center at Oklahoma City has taken delivery of this comprehensively equipped Electra for airborne training of Electra pilots and engineers. It is the FAA's first turboprop

the case had fares remained at a constant level." This seems an unnecessary statement of the obvious, unless Eagle are planning to cut cargo fares to Europe. They also emphasize their "heavy capital and development expenditure on existing services between the UK and Europe," and note that commercial facilities exist for the "fullest development of these routes by virtue of the company's relationship with the Cunard Steam-Ship Company."

British United's argument is rather more specific: they note the "marked trend" of inclusive tour business away from chartered to scheduled services, largely as a result of IATA's 1958 traffic conference, at which BEA obtained the right to carry inclusive tour passengers on scheduled routes. BUA say that tour operators will find it "increasingly difficult to charter whole aircraft," and they want these routes to provide for their "established IT market on a scheduled basis."

British United also put special emphasis on the use of London Gatwick. It is, they argue, "essential to recognize a separate traffic area centred on Gatwick." The use of this airport will also, they say, "lighten the load on London Heathrow, which is rapidly reaching saturation point."

—AND CUNARD EAGLE TO NEW YORK

APRIL 18 is the date set by the Air Transport Licensing Board for its first really important hearing—Cunard Eagle's application (number A.1000, the first to be received by the Board) to operate scheduled services across the North Atlantic. The application, it will be recalled, is for a licence to carry passengers, cargo and mail at a daily frequency—first with Britannias and later with big jets—from London (and/or Manchester and/or Prestwick) to New York and other US terminals designated in the US-UK air agreement, and Montreal and/or Toronto.

Cunard Eagle of course already have UK approval to operate a scheduled North Atlantic all-freight service. This was granted at the same time as BOAC's similar application, since when the corporation has inaugurated DC-7F all-freight services as a back-up to its fill-up-freight 707 services.

The reason why Eagle have not yet implemented their North Atlantic all-freight service is probably due to uncertainties over the IATA fare structure, with a cargo fare war about to break out on April 10. At any rate, interest now centres on Eagle's application for passenger services across the North Atlantic as Britain's second operator on the route. No objections on the score of "multiple designation" can come from the American CAB, since three US carriers—PanAm, TWA and Seaboard & Western—double-track with BOAC between the US and the UK.

BOAC will certainly object to the Cunard Eagle application, which is supported by a declaration that "maximum British participation in this market is vital. . . . A greater share of this trade will accrue to Britain by the introduction of a second British carrier to supplement existing British services." Eagle say that approval of the service "will enormously help the better development of our European, western hemisphere and transatlantic cargo services already licensed." They do not want the application to be considered as being directly dependent on any existing services, but they say that "there is a degree of interdependence, the results of which should not be ignored."

The existing western hemisphere services to which Eagle refer are, of course, those between Bermuda and New York, etc (on which Britannias are soon to replace Viscounts), and between London and Miami via Nassau. For more than two years Eagle has had associate companies registered in Bermuda and the Bahamas operating Viscount services to the US and Canada. No doubt the reciprocal rights enjoyed by American carriers in the two British colonies will be a useful bargaining counter if the Americans decide to raise difficulties about granting Eagle a foreign carrier permit for the North Atlantic.

WHAT FUTURE FOR THE ROTODYNE?

THREE days after inspecting the Rotodyne at Battersea Heliport (see photographs below) Mr Peter Thorneycroft, Minister of Aviation, was asked in the Commons some pertinent questions about the future of the civil helicopter. Previously Mr Geoffrey Rippon, Parliamentary Secretary to the MoA, had said that the Government might assist the proving of a helicopter based on the Belvedere "suitable for services to and from London."

"A civil version of the Belvedere," said Mr Thorneycroft in reply to questions about the decision to base the future of a civil helicopter on this type, "could only be an interim stage in the evolution of transport between city centres." He was not going to say how much money the Government had spent on the Rotodyne to date, because it would be contrary to normal practice. Nor did he say whether the offer to BEA of £1.4m for introducing the Rotodyne into commercial service still stood. The Minister also parried questions which invited his comment about continuation of the Rotodyne's development contract.

"I think the Rotodyne," he said, "is the prototype nearest in the world to being economic as a helicopter and it merits serious study to see whether we can deal with the noise and other factors and so warrant its introduction." He added, "I should not like to reply at the moment about the question of cost."

CAPE TOWN INTERNATIONAL

FROM April 1, a South African Airways Boeing will take off every week for London from D. F. Malan Airport, giving Cape Town a direct link with European capitals. This weekly flight will probably be scheduled to leave Cape Town to link up with SAA's west coast services from Johannesburg, which have now been resumed. These serve London via Brazzaville, Rome and Paris—the first time in years that SAA has called at Paris.

Introduction of the new direct service depends upon all three 707s being fully operational by April 1. Under discussion also is the best way to clear Cape Town passengers through immigration and customs at D. F. Malan Airport, so as not to delay them on arrival at Jan Smuts Airport. Much remains to be done in this direction, but that Cape Town is to become an air terminal for at least one weekly international flight is certain.

In London earlier this month was the Rotodyne, which landed for the first time at the Westland Heliport at Battersea where it was inspected (left) by the Minister of Aviation, Mr Peter Thorneycroft, and by the Air Minister, Mr Julian Amery. Noise measurements during take-off, descent and hover were taken at about seven points on both sides of the river between Battersea and Wandsworth bridges

AIR COMMERCE . . .

British Air Transport, 1960

A MEASURE of BOAC's and BEA's progress in the financial year ending March 31 is provided by provisional 1960 traffic statistics just issued by the Ministry. The most telling index of economic health is load factor, and it appears that both corporations experienced a decline in this index in 1960.

BOAC achieved an overall load factor on scheduled services of 56.9 compared with 57.6 in the previous year. Though this is a drop of less than one percentage point, the figure is still uncomfortably low. It is due entirely to a serious shortfall in traffic on western routes.

Though capacity on these routes increased by 43 per cent, traffic went up by only (relatively speaking) 32.7 per cent. Overall load factor, as a result, was a disquietingly low 50.2—a drop of four points on the previous year. BOAC are evidently not filling their transatlantic freight holds, even though freight ton-mileage leapt by nearly 43 per cent.

What BOAC lost on the western swings it partly regained on eastern and southern roundabouts, on which overall load factor shot up by four points to nearly 65 per cent. Historians will note that 1960 was the first year in which more than half BOAC's effort went into western routes—54 per cent compared with 48 per cent in 1959. But most of their business still came from the East and South—52 per cent compared with 55 per cent in 1959.

BOAC's biggest advances were on the non-scheduled front—mainly, it is presumed, in the booming North Atlantic charter field. The corporation flew more than 31,000 non-scheduled hours in 1960 compared with little more than 13,000 hours in the previous year.

The indications are that BOAC's financial results in 1960-61 are unlikely to be an improvement on results for 1959-60, when a net loss of £0.8m was recorded. It remains to be seen whether BOAC's reduced cost level (*Flight*, February 17, page 224) will compensate for the shortfall in revenues, and whether BOAC Associated Companies managed to improve on the £1.1m loss last year.

BEA This corporation's overall load factor slipped by half a percentage point, to 66 per cent. Nevertheless, this is a very healthy load factor, being six percentage points above the figure achieved two years ago. Total scheduled traffic on all BEA services, domestic and international, rose by nearly 19 per cent, a slightly higher growth-rate than in the previous year.

Once again, domestic traffic showed a higher rate of growth than international traffic—more than 28 per cent compared with not quite 16 per cent. The domestic proportion of BEA's total effort also went up again, being now 25 per cent in terms of capacity offered. In terms of passengers carried, domestic services accounted for 1.7 million of BEA's total of 3.9 million.

As always with BEA, a shortfall in traffic in the winter months can have an adverse effect on the whole financial year. According to Lord Douglas there was a shortfall in January; but there is no hint that the corporation's unbroken six-year profitability record is in danger, and there is every hope that the net profit of £2m last year will not be greatly reduced. Last September, Lord Douglas said he was hoping for £1¼m or £1½m in 1960-61.

Independents Biggest increases recorded by independent companies operating "in association" with the corporations were recorded on UK domestic services. Total passenger-miles went up by more than 46 per cent in 1960, compared with less than 16 per cent in the previous year. The independents for the first time carried more than half a million passengers on scheduled UK domestic services, an increase of nearly 45 per cent on the previous year. They carried in the UK nearly a third of the domestic passengers carried by BEA. Most of the independents' half million total would have been carried by Jersey Airlines, Silver City, BKS and Cambrian, in that order—though until ICAO publishes its traffic digest for 1960 the actual figures for these independents will not be known.

One of the biggest shortcomings of Ministry traffic figures is that there are no separate breakdowns for individual independents; those interested have to wait for them to be published by ICAO. If the figures are supplied to an international organisation, presumably by the Ministry, can they not be published beforehand in this country?

There are signs that, when the Air Transport Licensing Board is in full swing, much more information about the independents will be made available—including, it is to be hoped, information about non-scheduled operations and financial results. If the independents expect to be given an increasing share of British air transport, they must expect to be asked for much more information about their activities.

J. M. R.

BREVITIES

The Duchess of Kent is to open a new terminal building at Birmingham Airport on Friday, April 28.

Starways are negotiating with an American company the purchase of two DC-6s for delivery in about three months' time. An order for two Viscount 708s is being negotiated also with Air France.

Field Aircraft Services are now ARB-approved for the overhaul of Pratt & Whitney R.2800 engines. The company claims to be the only overhaul establishment in the country for this range.

Overseas Aviation are considering the use of AW Argosies on a vehicle ferry route between Gatwick and Ostend. They plan initially to use Bristol 170s if approval to operate the service is obtained.

According to *Aviation Daily*, Sud Aviation has decided to build for stock four Caravelle 7s (GE CJ805-23 turbofans) in addition to the prototype (Caravelle No 63) now under construction at Toulouse. The aircraft will incorporate all the modifications requested by American Airlines, who are said to be "one of the prime prospects" for the Caravelle 7. Meanwhile a new version of the Caravelle, the series 10, to be powered by Pratt and Whitney JT8D-A turbofans, will have a maximum weight of 113,540lb and improved payload-range performance. United are reportedly considering retrospective conversion of their Caravelle 6Rs with the P. & W. turbofan.

This is how BOAC 707 passengers will look when listening in to the much publicised "Hi-Fi" individual radio. Programmes of light music and talks, which will include advertising spots, are tape-recorded, and the plastic earphones are expendable for reasons of hygiene. There is individual volume control, and there will be no disturbance to other passengers

Smiths PVD for the Boeing 707 has been sent to the Boeing Airplane Co for installation in the 707-80 prototype.

The CAB has ordered Eastern Air Lines to cease advertising its DC-8s as "DC-8Bs." The Board considers this to be an "unfair and deceptive practice," following a complaint filed by Delta.

The FAA has awarded a C of A to the Boeing 707-120B (Pratt and Whitney JT3D-1). The aircraft, which first flew on June 22, 1960, and started certification testing on September 6, is cleared for a maximum cruising speed of Mach 0.9.

East Anglian (Channel Airways) have acquired a 76-80 seat DC-4 for delivery on March 30 and the purchase of another is being negotiated. The airline is interested in acquiring also Heralds, Ambassadors and Viscounts.

KLM has "definitely decided to buy the Convair 990" according to *Aviation Daily*, and an announcement is expected this month. Under the proposed technical co-operation programme with SAS and Swissair, overhaul of the aircraft and their GE engines will be done in Zurich by Swissair.

For the record, February 23 was the date on which the Armstrong Whitworth Argosy entered public commercial service, when Riddle (whose "Logair" Argosy operations are on behalf of the USAF) inaugurated a daily return service between Miami and San Juan, Puerto Rico.

In applying for a new service to Genoa, BEA say that "traffic now carried via Nice, Milan and Turin would be lost unless a direct route to Genoa could be opened," and they add that their considerable development expenditure on these routes would be lost also. The service would be inaugurated when the new Cristoforo Colombo airport is opened.

A BKS DC-3, G-AIWD, over-ran the runway at London on a flight from Leeds on March 9. A propeller blade was broken and some approach lights were damaged, but the 19 passengers and crew of two suffered no serious injuries.

Skyways are proposing to operate Continental Coach-Air services from Halifax. The operation takes the form of a coach journey from Halifax to Lympne (or Manston as an operation alternative) to Luxembourg, Basle or Lyon, from which there would be coach excursions.

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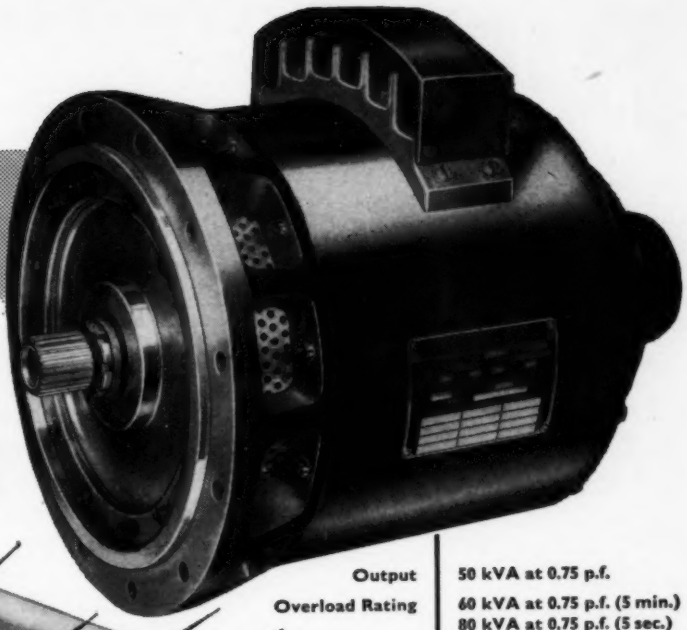

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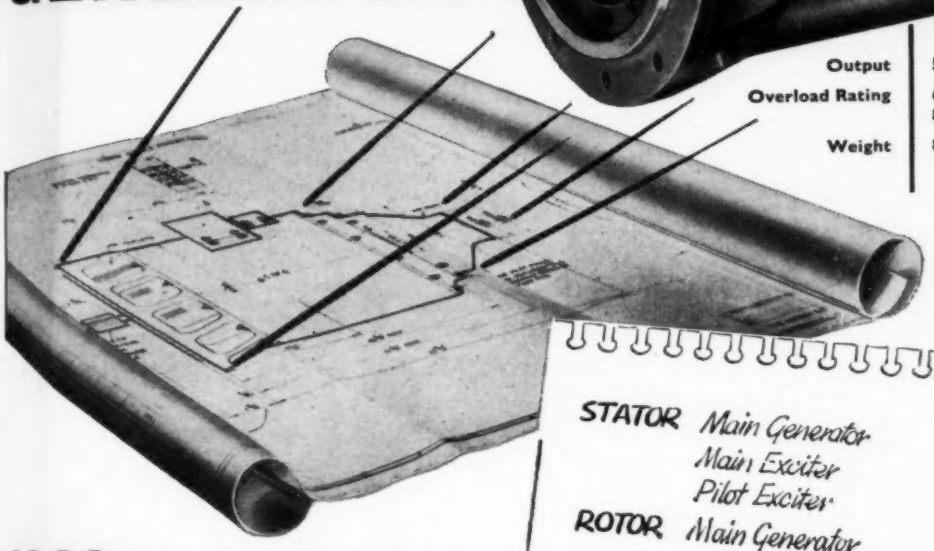

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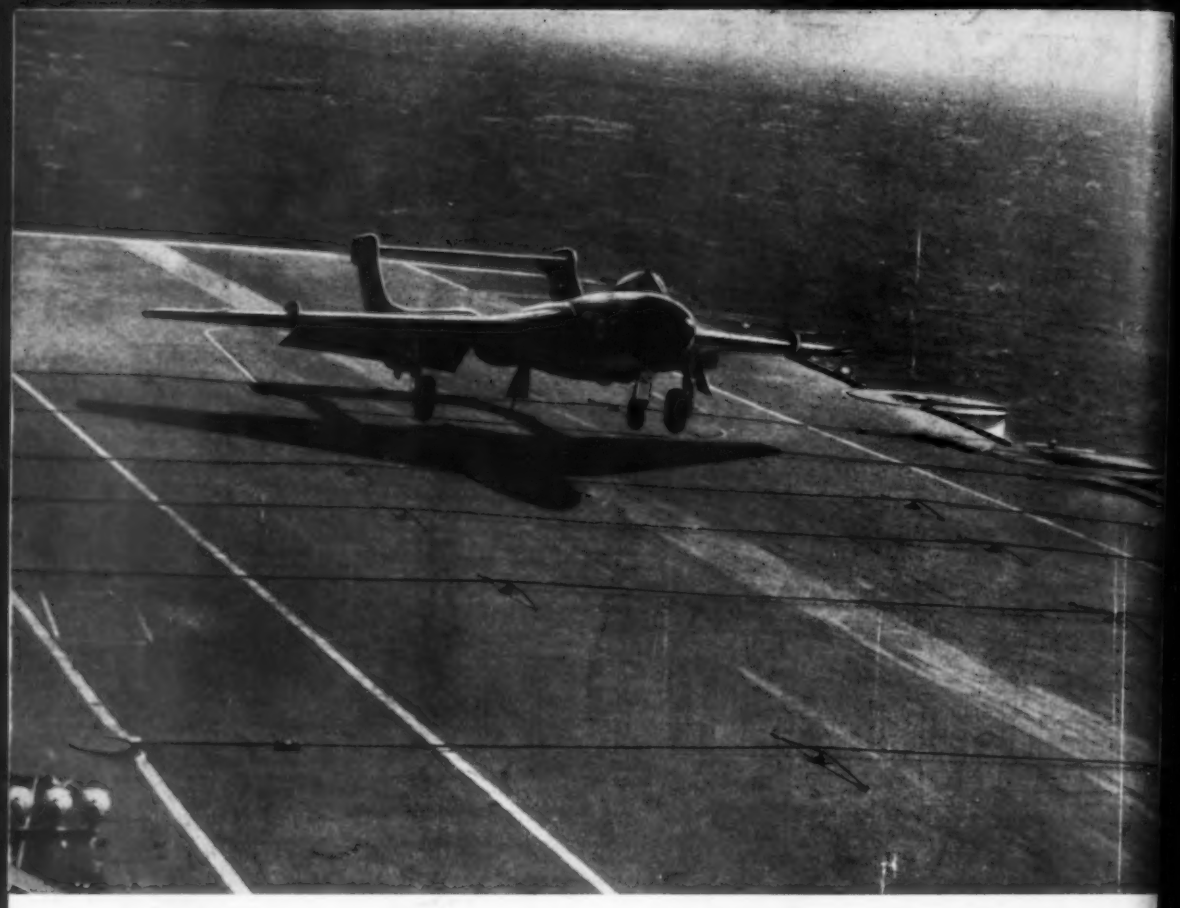

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